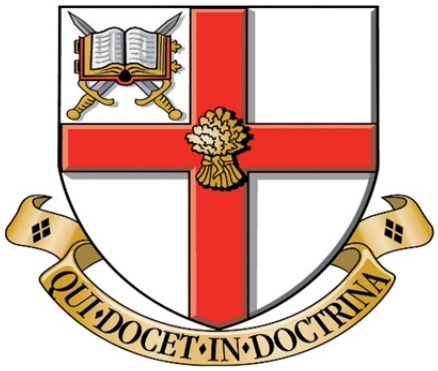

University of Chester

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The relationship between workplace stress and physical activity: a correlational study

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Dissertation submitted

in accordance with the requirements of

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for the degree of Master of Science

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Loren Grant
September 2010

Declaration

This work is original and has not been previously submitted in support of a degree, qualification or other course.

Signed.....

Date.....

Abstract

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Objectives: This study examined associations between levels of physical activity (PA) in both leisure and work time and stress in a specific population of NHS managerial and administrative staff (n=174). *Methods:* Data was gathered via a modified version of the International Physical Activity Questionnaire (IPAQ) on physical activity (PA), perceived stress levels at work and in personal life, health status, age, gender, job band, commuting distance and methods of transport, caring status and a range of perceived barriers to PA. The sample was stratified into low, moderate or high categories of activity using the IPAQ scoring protocol to calculate MET-mins/wk. Stress levels were coded 1(low) to 6 (high) from a Likert-scale type question. *Results:* Overall, there was a significant difference in stress levels between low activity and moderate and high activity groups. As levels of PA increased, levels of stress tended to decrease. The mean difference in stress scores between the low-activity and moderate activity groups was 1.14 (SE: 0.45) (p = 0.01) and the mean difference in stress scores between low-activity and high activity groups was 1.68 (SE: 0.48) (p = 0.00). However, there was no significant difference between the moderate- and high-activity groups although the high activity group had the lowest mean of stress (2.8). When results were separated for age groups, gender and income levels, some of these effects, especially for job bands (as a proxy for income levels) and health, could be confirmed. There were significant differences between some age groups in levels of PA, showing that older age groups are more active; and significant differences in PA amongst people in different job bands, with people on the highest job bands achieving the highest levels of PA and reporting the lowest levels of stress.

Conclusions: Individuals reporting low levels of physical activity report higher levels of stress, with a trend showing that as PA levels increase, stress levels decrease. However, as this is a cross-sectional study, the direction of the effect could not be confirmed. Further investigation into some of the barriers to PA amongst similar sedentary working populations may be of value for workplace health interventions.

Contents

Chapter 1: Introduction

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> The current human genome was moulded and refined through generations of time. We propose that the basic framework for physiologic gene regulation was selected during an era of obligatory physical activity, as the survival of our Late Palaeolithic (50,000–10,000 BC) ancestors depended on hunting and gathering. A sedentary lifestyle in such an environment probably meant elimination of that individual organism.
>
> Booth, Chakravarthy and Spangenburg, 2002

1.1 A long-standing relationship

The importance of exercise for physical and mental well being is not a new notion. The introduction of agriculture and the domestication of animals for food and labour, approximately 10,000 years ago, meant that the supreme physical fitness of the hunter-gatherer was no longer an absolute requirement for survival for many populations. Yet physical fitness was nonetheless prized for other reasons, ranging from imperial and military ambition to the achievement of optimal mental and psychological well being. The Persian Empire and ancient Sparta, both at the height of their power around 600BC, demanded high levels of physical fitness from the whole population, not just the military, and imposed rigid physical training programmes on their citizens (Dalleck & Kravitz, 2001).

Other ancient peoples also accepted the idea of physical activity (PA) for the promotion of mental and physical well being, notably in China, which has the earliest records of organised exercise for the purposes of health promotion, dating to around 2,500 BC (McAuley, 1994). The discipline of yoga, thought to have developed over 5000 years ago in India, was

intended to promote overall wellbeing through harmony between mind, body and spirit (Dalleck & Kravitz, 2001).

One civilisation in the ancient world which has arguably has had the most lasting influence on modern Western development is classical Greece, particularly the city-state of Athens (circa 500 BC) where philosophers such as Plato ('Lack of activity destroys the good condition of every human being, while movement and methodical physical exercise save it and preserve it'), and medical practitioners such as Hippocrates and Galen - considered to be the founding fathers of modern medicine - promoted the idea that PA was necessary for mental well being (Goldhill, 2004).

1.2 Physical activity, mental health and stress

Research in this area over recent decades has attempted to answer several questions: does PA improve mental well being, or does the impetus to PA depend on mental well being? Is there an independent effect? Or perhaps there is an interaction that defies easy analysis? The mechanism by which physical activity can affect mental states has been described as 'an extraordinary synergy of biological transactions, including genetic, environmental, and acute and adaptive neurobiological processes.' (La Forge,1995, cited in Mutrie, 2000).

More recently, a study noted that the relationship between specific types of PA and mental health 'appears to be much more complex ... than the relationship between PA and physical health.'(Asztalos, Wijndaele, de Bourdeaudhuij, Philippaerts, Matton, Duvigneaud et al, 2009). Others have cautioned against a reductionist approach which theorizes that psychosocial outcomes can be simply assigned to the effect of physiological or neurochemical activity (Rejeski, cited in Scully, Kremer, Meade, Graham, & Dudgeon, 1998).

However, there is some evidence from prospective studies that physical inactivity precedes depression (Mutrie, 2000), a disorder which the World Health Organisation predicts will be the second leading cause of disability worldwide by 2020. There is also evidence that stress, depression and anxiety are linked, and this is discusssed in more detail in Chapter 2.

1.3 How sedentary are we?

Fox and Hillsdon (2006) note that there have been institutional and cultural reductions in levels of PA since the 1950s at work and in the home, increasing levels of car ownership and increasing use of sedentary entertainment such as television, home cinemas and computer and video games. The Chief Medical Officer's report for England found that there has been a decline in physical activity as part of 'daily routines', but a small increase in the proportion of people taking physical activity for leisure (Department of Health, 2004).

For the first time in human history, food procurement for the vast majority of people is no longer linked to PA: the 'natural linkage' between caloric acquisition and caloric expenditure has been broken (Eaton & Eaton, 2003). 'Occupational physical activity has declined since the turn of the twentieth century. The most prevalent occupations have shifted from heavy manual labour . . . to service sector and high technology occupations that require little energy expenditure.' (French, Story & Jeffery, 2001).

Environmental changes are considered to be the primary cause of current levels of obesity (Prentice & Jebb, 1995) since the speed and prevalence of the epidemic over the past 40 years rule out major genotype changes, which take place much more slowly. Part of the problem noted by some observers is that we have little or no data on unstructured and 'lifestyle-embedded' activity over the past several decades (Tremblay, Esliger, Copeland, Barnes & Bassett, 2008), which makes it difficult to quantify how much PA we have 'lost'

through recent environmental and social changes and to explore the hypothesis that there has been a gradual erosion of daily physical activity. Because of this, there has been increasing interest in both the evolutionary and 'lost lifestyle' aspects of PA.

Tremblay et al (2008) studied three groups of children: Old Order Amish (OOA) and Old Order Mennonite (OOM) communities who pursue lifestyles of 100 and 60 years ago respectively, and a group of contemporary living (CL) children. Findings were that the children from the OOA and OOM groups were stronger and fitter than the CL group, and that OOA children were leaner than the OOM and CL groups, which the researchers indicate may be the result of higher levels of 'lifestyle-embedded' activity, including active commuting to school and chores.

When researchers at Deakin University in Melbourne, Australia, wanted to compare activity levels of modern and historical lifestyles, they chose as the 'historical' cohort a group of actors paid to live like early Australian settlers at an historical theme park near Sydney (Egger, Vogels & Westerterp, 2001). It is a striking illustration of how difficult it is to find contemporary occupations which require any significant physical effort; from factory workers to farming, automation and mechanisation of many processes are now the norm, and the human contribution may only involve pressing buttons or using a keyboard, standing or sitting. Egger et al found that the theme park actors expended the energy equivalent of walking up to 16 km more – 2.3 times greater than modern sedentary workers.

However, the evolutionary perspective is a much longer one. Ninety-five per cent of human biology... (was) 'naturally selected during the time period in which our ancestors lived as gatherers of wild food resources.' (Trevathan et al., 1999 cited in Booth, Chakravarthy & Spangenburg, 2002).

The homeostatic system in humans which regulates the complex relationship between energy intake and expenditure therefore remains very similar to that originally selected for our Stone Age ancestors who lived by gathering and hunting (Cordain, Gotshall, Eaton & Boyd, 1998). Some evidence to support this can be found in the world's remaining 'hunter-gatherer' societies, who do not suffer obesity or its co-morbidities such as diabetes and cardiovascular disease, nor some of the other consequences of a modern Western lifestyle such as dental caries, depression or hypertension (Eaton, Konner & Shostak, 1988).

The Booth et al. study (2002) notes that the 'phenotype' (the expression of the interaction of the environment and genotype) of *homo sapiens* today is very different from our ancestors. Because our physiology is programmed for a 'late Paleolithic' lifestyle, but is being expressed in a predominantly sedentary environment, this has led to the 'disruption of ancient, complex, homeostatic systems', which may provide an explanation for the huge rise in non-communicable diseases in modern, developed societies. Cordain et al. conclude that research into the optimum levels of physical activity for human health could be guided by understanding our evolutionary history.

1.4 Benefits of physical activity

Aside from the accumulating evidence linking physical inactivity to weight gain (Bensimhon, Kraus, Donahue & Durham, 2006), there are many other reasons for encouraging physical activity in the population; exercise appears crucial in reducing the risk of a host of non-communicable diseases, including cardiovascular problems, while physical inactivity is the fourth leading risk factor for global mortality (World Health Organisation, 2010). Regular physical activity is also associated with a reduced risk of diabetes, obesity, osteoporosis and

colon cancer, and with improved mental health (US Department of Health and Human Services, 1996). In older adults physical activity is associated with increased functional capacities (Huang et al., 1998).

Physical *in*activity is associated with social deprivation, low income and educational attainment, indicating that the promotion of physical activity is particularly important in these groups (Hillsdon, Foster, Naidoo & Crombie, 2004). A decade earlier (Biddle, Fox, Boutcher, 2000) it was identified as the fourth primary risk factor for coronary heart disease and stroke, and a decade before that, a systematic review found that people who have a physically active lifestyle are at approximately half the risk of developing coronary heart disease (CHD) compared with their sedentary counterparts (Berlin & Colditz, 1990). The Berlin and Colditz review was carried out against a background of growing evidence for the independent role of increased physical activity in the primary prevention of coronary heart disease.

In addition, sedentary living is also the most *prevalent* risk factor for heart disease, while physically fit but obese individuals have a cardiovascular risk profile that is more akin to that of thin, fit subjects than that of their obese, but sedentary, counterparts (Lee & Skerrett, 2001, cited in Bensimhon et al., 2006).

Yet the negative health effects of low levels of physical activity have been slow to emerge as a 'top of the mind' concern amongst the general public, unlike other more well-established health risks such as smoking, hypertension and Type II diabetes. The last two decades in the UK have, therefore, seen increasingly urgent attempts by government and public health experts to increase the levels of physical activity amongst the population, both adults and

children, particularly in response to the 'epidemic' of obesity which seemed to be following a trend similar to that experienced in the USA.

As early as 1996, the UK government introduced a new policy promoting 30 minutes of moderate intensity (3-6 METs, or 5-7.5kcal/min) physical activity on at least five days a week; for those already engaging in vigorous physical activity, a minimum of three 20-minute sessions periods a week of vigorous activity (Department of Health, 1996). However, the recommendations were slow to take effect – the Health Survey for England in 1998 found that only 40% of men and 26% of women were physically active at either of these levels (Department of Health, 2000).

In the most recent recommendations from the Chief Medical Officer (Department of Health, 2004), adults should undertake a total of 'at least 30 minutes a day of at least moderate intensity physical activity on five or more days a week.' and that physical activity was a "major independent protective factor against coronary heart disease."

This rationale for this study is therefore to examine a possible correlation between work-related stress and a motivation to be more physically active. Barriers to healthy lifestyles in terms of diet and activity relate to both physical and emotional issues (Jebb, Steer & Holmes, 2007). Could psychosocial stress therefore plausibly be one of the barriers to being more active? There is accumulating evidence that physical activity moderates the damaging health effects of psychosocial stressors, but is it possible that stress can lead to mood disorders and depression which sabotage healthy behaviours such as undertaking physical activity? Alternatively, could the effect be bi-directional? If stress levels reduce physical activity can this in turn exacerbate stress and negative mood states?

Chapter 2: Literature Review

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2.1 Introduction and scope of literature review

This chapter reviews the literature on the links between psychosocial stress, particularly in the workplace, and levels of physical activity inside and outside the workplace. The main concepts and theories examined include

- definitions of physical activity
- types of physical activity
- some problems involved in measuring levels of activity within populations
- definitions of stress and a discussion of its impact on physical and mental health; and
- how the effects of stress may affect motivations to undertake healthy behaviours.

One of the main obstacles to a fuller understanding of the interactions between physical activity and stress is that both are hard to measure objectively and accurately in free-living populations; but in controlled groups, accurate measures can be time-consuming, expensive and invasive (Schoeller, 2008). Even if both factors could be measured more easily and objectively, the complex interplay of physiological, psychological and neurological processes might make determining cause and effect a challenge.

In addition, because the stress response involves mental and psychological as well as biochemical reactions, separating out cause and effect becomes even more difficult as the psychophysiological response may began to feed on itself: 'state anxiety may also be elevated due to increased awareness of the physiological responses to stress.' (Taylor, 2000).

Evidence for the health benefits of increasing levels of physical activity within the UK population is examined; in particular how physical activity moderates the negative effects of the stress response. The public health and economic imperatives for increasing levels of physical activity and reducing workplace stress are outlined. National and international guidelines and recommendations for minimum levels of physical activity are reviewed and compared.

2.2. Search strategy

Searches were conducted of Bandolier; NHS Evidence Specialist Collections; EMBASE; HMIC; PsycINFO; MEDLINE from PubMed; CINAHL; National Library of Guidelines (including NICE Guidance); Clinical Knowledge Summaries (formerly Prodigy) using terms to reflect the concepts of:

- relationships between stress and physical activity
- the health belief model
- theories of self-efficacy
- the theory of planned behaviour
- workplace stress and physical activity
- measuring daily physical activity
- biological effects of stress
- physical activity and mental health
- validated questionnaires for self-reports of physical activity
- validated questionnaires for self-reported levels of psychosocial stress

Key search terms included 'physical activity and stress', 'workplace stress', 'barriers to physical activity', 'motivations for health behaviours', 'International Physical Activity Questionnaire', 'benefits of physical activity'. Additional searches were conducted using internet search engines (Google and Google Scholar) and key references from retrieved articles were screened for inclusion. Websites of key organisations were also searched for

relevant strategies, policies, statistics and research, including the Health and Safety Executive; The World Health Organisation; Chartered Institute of Personnel and Development; Xpert HR; The Office for National Statistics; Department of Health.

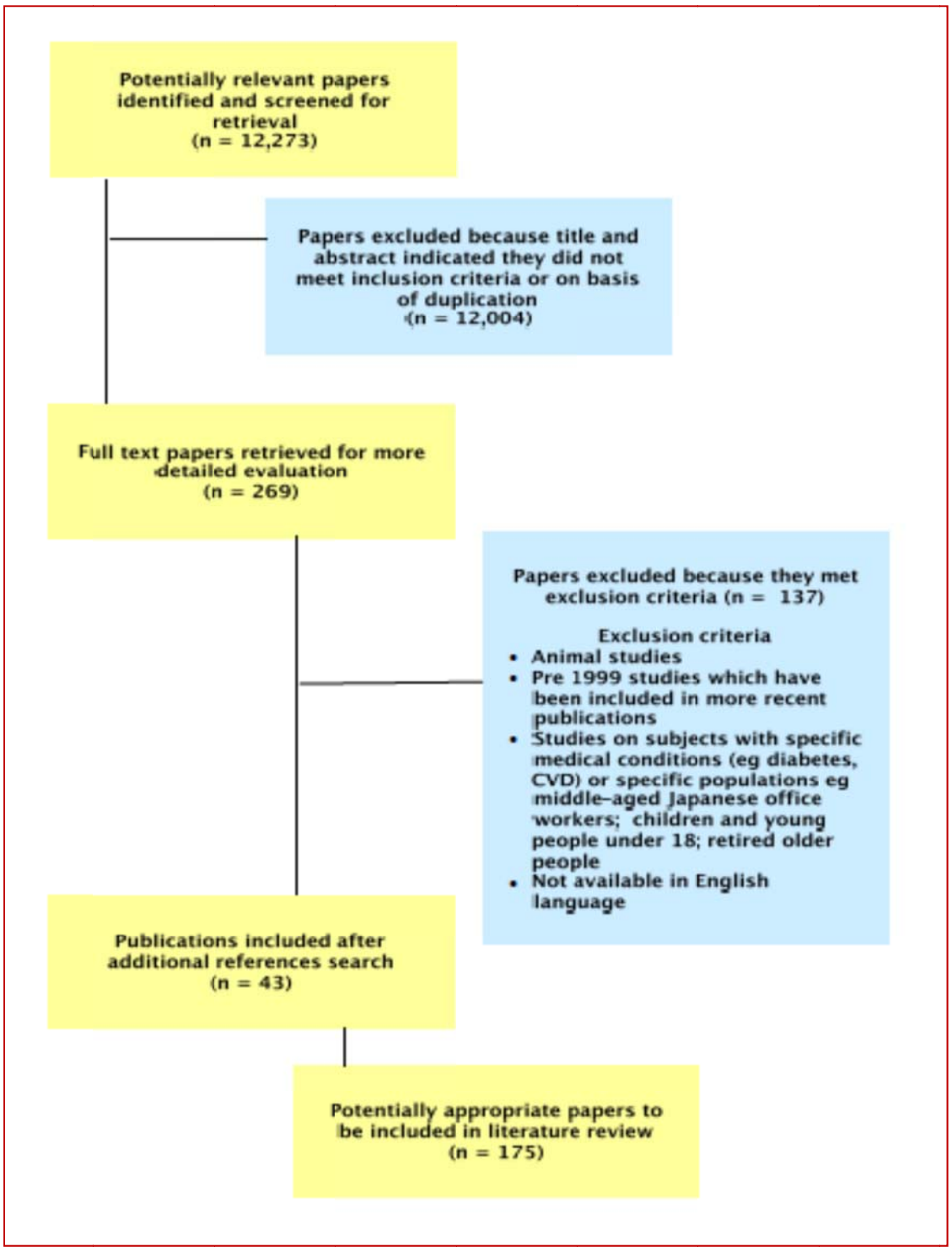

Figure 2.1: Flowchart showing search strategy

2.3 Our sedentary lifestyles

There is a need to increase levels of physical activity across the globe for long-term public health reasons (World Health Organisation, 2010), which, crucially, will involve identifying the barriers which prevent people from being more active. There is also increasing awareness of the implications of *sedentary behaviour*; for example, activities involving low-energy expenditure, such as watching television, using a computer, talking on the phone, driving, sitting in a classroom, reading, listening to music, talking with family and friends and cognitive hobbies (Kalra & Newman, 2009).

Since most people in the UK live in an environment which discourages physical activity (Fox & Hillsdon, 2007), and where sedentary occupations have become the norm and cars have replaced more active forms of transport (Jebb, Steer & Holmes, 2007), there is a need to understand how best to encourage and motivate the population to increase the amount of everyday spontaneous physical activity. For example, the government's Change4Life social marketing programme, launched in January 2009, instead of exhortations to join a gym or take part in organised sports, suggested simple, manageable alterations to daily routines which would be achievable by most people; these include getting off the bus a stop early, or parking slightly further away from the shops.

The population chosen for this study – employees of NHS North West, the strategic health authority (SHA) - is typical in many ways of the wider UK working population. Many SHA staff commute by car, or take a bus or train, walk a short distance from the station to their work location, use the lift and then sit for most of the day. Being sedentary rather than active is the default during a normal working day.

Since the SHA is part of the NHS, staff may be better informed about the benefits of physical activity and the consequences of a sedentary lifestyle but as is now well understood through research into the principles of health behaviour change, awareness does not always translate into practice unless individuals are motivated and empowered to change (King's Fund, 2008).

Information and education are 'disappointingly ineffective' tools for persuading people to change behaviours (Mulgan, 2010). Insights from the field of behavioural psychology show that people tend to pay more attention to potential losses than gains, so that acting to reduce a risk is *less* likely (for example, increasing physical activity to reduce the risk of heart disease) than changing a behaviour which would result in an increased risk if we failed to act – such as wearing a seat belt (Mulgan, 2010).

Because the risks of sedentary living are now well recognised, however, by health agencies, and governments (Kalra & Newman, 2009), focus is increasingly turning to the workplace as a health promotion setting, because of the significant proportion of time spent at work. It is estimated that individuals may spend up to 60% of their waking hours in their place of work (Peersman, Harden & Oliver, 1998). 'The workplace therefore offers a significant potential setting for physical activity and health promotion.' (Sport England, 2007).

In its guidelines for healthy workplaces, the World Health Organisation notes that addressing diet and physical activity in this setting can reduce sick leave and staff turnover costs, improve productivity and contribute to a positive and caring image of the company (WHO, 2010). But for workplace health programmes to work, senior management need to 'target reasons and motivations' for staff engaging or failing to engage in healthy behaviours, the report concludes.

As Dishman, Sallis and Orenstein (1985) pointed out in their review of the known determinants of PA, 'one barrier to developing effective methods to encourage physical activity among all segments of the population is lack of knowledge of the determinants of regular physical activity.' In particular, the behavioural determinants remain poorly understood, Dishman et al. concluded. Although all the studies reviewed had several limitations, including relying on correlational rather than experimental data, out of 23 personal characteristic variables identified, mood disturbance was the only variable repeatedly documented as showing *decreased* probability of participation, in both structured and spontaneous exercise.

2.4 Definition of physical activity

It is important to distinguish between physical activity, physical exercise and physical fitness since they all pose different issues for measurement. *Physical activity* (PA) is defined as any bodily movement produced by skeletal muscles that results in energy expenditure, which can be measured in kilocalories (Kcal) (Caspersen, Powell & Christenson, 1985). The energy cost of physical activity can also be measured by the expenditure of energy above the basal or resting metabolic rate (BMR/RMR), which is the rate at which the body uses energy when it is at rest but still maintaining vital body organs and functions. *Inactivity* is defined as expending ~<300Kcal/day above basal metabolic rate (Paffenbarger, Hyde, Wing & Chung-cheng, 1986). PA can be further defined by levels of intensity, frequency, duration and type (for example, occupational or leisure).

***Table 2.1*: Definition of concepts used in guidelines for physical activity (adapted from *Global Recommendations on Physical Activity for Health*, WHO, 2010)**

Type of physical activity	The mode of participation in physical activity. For example, aerobic, strength, flexibility, balance.
Duration	The length of time in which an activity or exercise is performed usually expressed in minutes
Frequency	The number of times an exercise or activity is performed, generally expressed in sessions, episodes, or bouts per week
Intensity	The rate at which the activity is being performed or magnitude of the effort required
Moderate-intensity physical activity.	performed at 3.0–5.9 times the intensity of rest
Vigorous-intensity physical activity	performed at 6.0 or more times the intensity of rest

Exercise is physical activity which is planned, structured and repetitive and is intended to maintain or improve physical fitness (Caspersen et al., 1985) – for example, any active sport. The term *physical fitness* is used to indicate the capacity to perform physical tasks requiring strength, endurance, flexibility and balance. It therefore indicates a measurable set of attributes that are either health- or skill-related (Caspersen et al., 1985). Fitness can be objectively assessed by measuring an individual's 'VO_2max' - the volume of oxygen consumed while exercising at maximum capacity. Exercise and physical fitness are therefore easier to measure objectively than physical activity, which is one of the key variables in this study.

There are over 30 methods for assessing levels of PA (Dugdill & Stratton, 2007), using a range of subjective methods such as activity diaries, surveys and questionnaires, or objective methods including pedometers, heart-rate monitors, the 'doubly-labelled water' method and indirect calorimetry (measuring oxygen uptake and carbon dioxide production) but these tend to be more expensive, invasive and time-consuming. However, as yet, no standardised instrument able to capture all the facets of PA is available (Hagströmer, Oja & Sjöström, 2007), although Haslam and James noted in 2005 that reliable, direct measures of physical

activity, such as combining data from heart rates and motion sensors, were beginning to emerge.

Thus, estimating levels of total PA and intensity of PA with any degree of accuracy in the day-to-day life of free-living populations is difficult, particularly when relying on self-reported activity, as with the research reported in this study. A 1992 study found that obese subjects "underreported their actual food intake by an average (+/- SD) of 47 +/- 16 per cent and over-reported their physical activity by 51 +/- 75 per cent." (Lichtman, Pisarska, Berman, Pestone, Dowling, Offenbacher et al.,1992), and later studies have supported these findings both for over-reporting physical activity (Adams, Matthews, Ebbeling, Moore, Cunningham, Fulton et al., 2005) and under-reporting food intake (Rennie, Jebb, Wright & Coward, 2005) although the latter research was amongst young people.

'The inherent limitations of self-report measures of activity for population surveillance of energy expenditure are so great that alternative strategies, including use of objective monitoring, are required.' (Wareham, 2007). Studies using the 'doubly-labelled' water process show that there can be up to a 20% difference between self-reported energy intake compared with energy expenditure (Hill & Davies, 2001).

With self-reporting of PA there may be a risk of over-reporting of duration and intensity for a variety of reasons, including the wish to provide socially desirable responses; this can vary across social groups, depending on the norms and values prevalent in each group (Rzewnicki, Auweele & de Bourdeaudhuij, 2003). For example, 'people with higher education and income may tend to over-report PA since their peers value a healthy lifestyle more than individuals in lower classes' (*op.cit.*), while less educated and older males may have a propensity to over-report physical activity from the distant past.

However, social desirability response bias is likely to be more of a risk where the subjects are being interviewed face to face or via a telephone survey. In a self-administered, online survey such as the one developed for the purposes of this study, there is no immediate 'other' from whom respondents may wish to gain approval.

The instrument used for the survey in this study is based on the short version of International Physical Activity Questionnaire (IPAQ which has been extensively tested and is now used widely (Hagströmer et al., 2006). A study by Craig et al. (2003) found that, overall, the IPAQ instruments have acceptable measurement properties, at least as good as other established self-reports, for monitoring population levels of physical activity among 18- to 65-year-olds in diverse settings. However, a comparative study by Rutten, Ziemainz, Schena, Stahl, Stiggelbout, Auweele, Vuillemine et al., (2003) of PA measurement methods in eight different countries produced more mixed results, with the IPAQ tending to produce higher estimates of PA and caloric expenditure than others.

2.5 How active should we be?

There is general agreement on the importance of physical activity to health for both individuals and populations (World Health Organisation, 2010) but there is still a requirement for a fuller understanding of how much activity is needed, and at what level of intensity, to confer different benefits (Hagströmer et al., 2006). For example, is there a dose-response effect, or are there levels of intensity beyond which no further benefits can be obtained?

Nevertheless, there is strong evidence that active adults have lower rates of all-cause mortality, coronary heart disease, high blood pressure, stroke, Type 2 diabetes, metabolic

syndrome, colon and breast cancer, and depression. (WHO, 2010). Physical inactivity has been identified as the fourth leading risk factor for global mortality (6% of deaths globally) (WHO, 2010) and estimated as the main cause for approximately 21–25% of breast and colon cancers, 27% of diabetes and approximately 30% of the ischaemic heart disease burden. Physical inactivity is thus a greater risk than excess bodyweight – which is only the sixth most important risk factor contributing to the overall burden of disease worldwide (Haslam & James, 2005)

In an update of its 2001 position stand, the American College of Sports Medicine (ACSM). distinguishes between 'lifestyle approaches to increasing PA' and 'lifestyle forms of PA'. The former definition applies to interventions incorporating behavioural theories and constructs to 'assist and facilitate increasing PA within one's lifestyle', for example the Health Belief Model. These approaches could be useful in helping individuals to increase their levels of physical activity including structured exercise, leisure time physical activity (LTPA), occupation and household activity and commuting (Donnelly, Blair, Jakicic, Manore, Rankin & Smith, 2009).

'Lifestyle forms' of PA are any 'non-structured form of PA performed that is not intended to constitute a structured period of exercise.' The ACSM proposes that 'non-exercise activity thermogenesis (NEAT)' should be used to describe all energy not expended from eating, sleeping and planned exercise – this would include walking for commuting purposes which is one of the aspects of PA included in this study. The contribution of NEAT to weight management is emerging as an interesting area for research. The ACSM indicates that, since only a small positive energy balance over time would be required to cause obesity, promoting lifestyle PA is a plausible solution.

The most recent guidelines on PA from the World Health Organisation (2010) focus on physical and mental health benefits (rather than the levels needed for weight loss as in the ACSM position stand) but are closely aligned with the ACSM position; the guidelines for adults aged 18-64 are relevant to the population in this study, except where the levels might be contra-indicated by specific medical conditions.

A systematic review of studies on the short-term effects of single continuous or accumulated short episodes of exercise (but totalling the same amount of time) found similar fitness outcomes (Murphy, Blair & Murtagh, 2009). This suggests that people in mostly sedentary jobs could nevertheless accumulate enough PA in short bouts during the working day (such as a lunchtime walk or using the stairs instead of the lift) to confer health benefits. However, the studies only looked at the short-term effects and did not examine implications for mental well-being.

2.6 An historical perspective

Physiologists argue that the current human genome was developed in an era of obligatory physical activity; our 'Stone Age' genes are not designed for space age living and many chronic and degenerative diseases, not just obesity, can be linked to low levels of physical activity and sedentary lifestyles (Booth, Chakravarthy & Spangenburg, 2002). Eaton and Eaton (2003) calculated that the World Health Organisation's recommended daily energy expenditure level of 490 kcal/d 'most closely approximates to the Paleolithic standard for which our genetic makeup was originally selected' and therefore the level most likely to prevent the many non-communicable diseases associated with sedentary lifestyles.

2.7 Economic case for improving physical activity

Physical activity offers a range of health benefits, including reducing mental and emotional stress and helping to prevent obesity or reduce the risk of weight regain after weight loss. There has been a growing recognition over the past decade that it is important to tackle both of these issues – stress and overweight and obesity – not just as public health and medical problems, but for economic and employment reasons. In 2002, the Wanless Report, commissioned by the Treasury Department, warned that the NHS would become 'unaffordable' if the UK did not tackle the unhealthy lifestyles which lead to chronic diseases such as obesity and its co-morbidities.

2.8 Economic and social costs of psychosocial stress

There has been increasing recognition in recent years of the problems associated with work–related stress, which is widespread in the UK working population, is not confined to particular sectors or high risk jobs or industries and is on the increase (Health and Safety Executive, 2009). The HSE *Self-reported Work-related Illness Survey 2004/05* found that 12.82 million working days were lost to stress, anxiety and depression in 2004–05, with an estimated cost to the UK economy of £3.7 billion a year; between 2007 and 2008, this had increased to 13.5 million working days (http://www.hse.gov.uk/pubns/indg406.Pdf). Interestingly, the HSE does not mention encouraging PA as a strategy to moderate stress in the workplace.

Workplace stress is estimated to be the biggest occupational health problem in the UK after musculo-skeletal disorders (MIND, 2005), a proposition supported by the Boorman Report on the NHS workforce (2009), which found that these two conditions were the main causes of sickness absence. The NHS is the largest employer in the UK, with approximately 1.7 million staff in about 400 organisations, and sickness absence costs the NHS alone

£1 billion a year, with serious implications for the effective delivery of health and social care services. (Department of Health, 2009). A key study on work-related stress amongst hospital consultants and NHS managers (Caplan, 1994) found that levels of anxiety and stress were higher than expected.

The CBI estimates that 30 times as many days are lost from mental ill health than industrial disputes and half of those days lost are due to anxiety and stress conditions (MIND, 2005). The direct costs to business and industry can be calculated in financial terms while the costs to the NHS are also significant both in terms of treatment and the proportion of time GPs and other health professionals spend dealing with the problem and its consequences. Last but not least the human cost – the burden borne by the individual and those closest to them – must be incalculable : stress is literally a killer.

2.9 The biological response to stress

First defined as a 'general adaptation syndrome' developed as a response to damaging stimuli (Selye, cited in Holmes, Ekkekakis & Eisenmann, 2009), the stress reaction in humans and other mammals is an evolutionary response to perception of danger or threat in the environment which creates adrenocortisol arousal (Goleman, 1996). It stimulates the release of hormones designed to improve our chances of survival in the face of immediate danger – for example, attack from a predator. The hormones released in the stress response include catecholamines (adrenaline, norepinephrine and dopamine) and cortisol.

Catecholamines prepare the body for swift action, liberating stored glucose and free fatty acids to provide fuel for the large muscles needed for 'fight or flight'. Cortisol downregulates the insulin response, keeping blood glucose levels high to ensure large

muscles have ready access to more fuel; and finally cortisol and catecholamines also stimulate the 'stickiness' of blood to protect against potential haemorrhage from wounds.

Modern humans may feel endangered for different reasons – a 'symbolic threat to self-esteem or dignity; being treated unjustly or rudely treated, being insulted or demeaned, being frustrated in pursuing an important goal.' (Goleman, 1996). However, the biological response is the same as when our ancestors reacted to a concrete environmental threat or stressor and unfortunately the generalised adrenal and cortical excitation can last for hours and even days (Goleman, 1996).

A systematic review (Dickerson & Kemeny, 2004) of 208 laboratory studies of acute psychological stressors found that the largest cortisol and adrenocorticotropin hormone changes were associated with tasks containing both uncontrollable and social-evaluative elements: circumstances which can apply to both work and non-work related stressors. This supports a definition of stress offered by Taylor (2000) as arising from 'an imbalance between our perceived capabilities and perceived situational demands.' The Dickerson and Kemeny review also found that these situations had the 'longest time to recover', that is, when cortisol levels returned to normal.

Persistent high levels of cortisol are associated with a host of serious health conditions including suppressed thyroid function, hyperglycaemia, decreased bone density, decrease in muscle tissue, higher blood pressure, lower immunity and high inflammatory responses in the body, slow wound healing and increased abdominal fat; accumulation of fat around the waist (central adiposity) is in itself linked with other health problems including cardiovascular disease and development of the metabolic syndrome. (Fraser, Ingram, Anderson, Morrison, Davies & Connell, 1999).

In summary, the stress response, while essential as a short-term strategy, can lead to health problems if it becomes a chronic state. 'Prolonged inappropriate response to stressors may result in cardiovascular, metabolic and immunological changes linked to chronic health problems'. (Selye, 1956, cited in Taylor, 2000).

However, it is not only a physiological state – stress can manifest itself in emotional states and behavioural responses (Taylor, 2000) which is why it is of interest as a factor in health behaviours; as indicated in Chapter 1, the link between stress and depression has long been observed. Many prospective studies have also shown than low PA predicts depression (Mutrie, 2000) which suggests that lowering stress levels may also lower the risk of depression. The associations between stress, depression and PA, therefore, are likely to be an area of interest for those wishing to increase levels of PA in the population.

2.10 Stress and physical inactivity

Postprandial lipaemia, hyperglycaemia, mental stress ***and/or*** physical inactivity (a typical day in the office?) can all lower nitric oxide (NO) expression levels in vessel walls (Abdu et al. 2001; Kelm, 2002, cited in Booth et al.,2002). The results of normal expression of NO include direct and indirect vasodilation, an anti-thrombotic effect (making the blood less 'sticky') and an anti-inflammatory effect. When NO production is impaired, as in the stress response, the results can include vasoconstriction and hypertension, thrombosis, inflammation, obesity, Type 1 and Type 2 diabetes, heart failure, atherosclerosis and ageing (Klabunde, 2007).

It is therefore plausible that the combined effects of mental stress and physical inactivity can lead to chronic impaired production of NO and development of some or all of the health problems described above.

2.11 Links between stress and depression

Many studies have observed that there is a link between chronic stress and depression, and investigations have also been carried out into the underlying psychoneuroendocrinological processes (van Praag, 2004). Van Praag's study into whether stress can cause brain disturbances suggests that the effects of sustained stress mimic the disturbances in brain chemicals found in depression and these are 'of pathophysiological significance and not merely a consequence of the depressed state or a product of stress generated by the depressed state.' The study confirmed that stress, anxiety and depression pathways connect through distinct processes in the brain and furthermore, concluded that stressful experiences can also make the symptoms of anxiety and depression more severe and recommends reducing stress through both biological and psychological means.

2.12 Effects of physical activity on self-reported levels of stress

Although the idea that physical activity protects people from the negative impacts of stressors in daily life is not a new one, (Taylor, 2000) the mechanisms are not yet completely understood. There are three aspects of the inter-relationship of stress and physical activity to be considered. PA may offer substantial benefits on its own or as an adjunct in improving mood states and thus psychological well being (Fox, Boutcher, Faulkner & Biddle, 2000); the independent negative effects of stress can be mediated by PA since it uses the same biological pathways. 'A bout of exercise ... itself can be a stressor and, ... can engage most of the same biological pathways as psychosocial stress. (Holmes et al., 2009).

and finally the hypothesis that is of concern to this study, that stress - by inducing negative mood states - may discourage people from PA.

Immediate and more-long term improvements in mental well-being from undertaking PA have been linked to both physiological and psychological effects. Bodily changes which promote a feeling of well being include an increase in core body temperature, release of beta endorphins, reduced muscle tension and reduced 'excitability' of the central nervous system (that is, sensations of calmness) (Taylor, in Biddle, Fox & Boutcher, eds. 2000).

The psychological benefits of PA include increased sense of relatedness, autonomy and competence (White, Kendrick & Yardley, 2009**).** Mutrie (in Biddle et al, eds, 2000) note that PA and exercise, amongst other psychological benefits, appear to alleviate symptoms of mild to moderate depression and may alter aspects of the stress response and Type A behaviour.

A large number of earlier cross-sectional studies, reviewed in Taylor (2000) were found to vary considerably in quality, but, as large epidemiological studies, could provide some 'good generalisability' on the association between anxiety levels and levels of activity and fitness. However, 27 longitudinal studies in the same review, which typically measured anxiety at baseline, followed by a period of weeks or months of exercise and then follow-up measures, provided inconclusive results, with 33% of studies reporting no anxiety-reducing effect.

2.13 Cross-sectional studies on PA and mental health

Evidence amassed from other studies over the past two decades do, however, indicate that PA can benefit psychological well being (Sculley, Kremer, Meade, Graham & Dudgeon, 1998), including a wide-ranging review by McAuley (1994) who identified the 'the positive correlation between exercise and self esteem, self efficacy, psychological well being, and

cognitive functioning, and the negative correlation between exercise and anxiety, stress, and depression.'

A major cross-sectional study in 2004 (Abu-Omar, Rutten & Lehtinen) comparing data on physical activity and mental health across 15 European countries, including Great Britain, aimed to address a gap in understanding on the dose-response relationship between PA and mental health. Data was collected on 15,722 subjects (approximately 1,000 per nation) as part of the Eurobarometer survey (mean response rate 54.6%), with physical activity assessed by the short form of IPAQ and mental health assessed using two scales – the (Mental Health Inventory (MH1-5) and the Energy and Vitality Scale (EVI-scale). The main findings were that less active respondents scored lower on the mental health indicators; and that both men and women who are physically active experience better mental health. The relationship held for different age groups, marital status and levels of education. A dose-response relationship was found in most but not all national groups in the study, while the highest levels of depressive disorders were found in urban Great Britain. However, potential confounders such as socio-economic status, age and gender were not controlled for. In addition, as with other cross-section studies, causality cannot be determined and there is likely to be limited reliability and validity where subjective (self-reports) of physical activity are used as a measure.

A recent study into the reactions of three different groups of men to psychosocial stressors (elite sportsmen, amateur sportsmen and untrained men) found that different levels of PA were associated with different physical and psychological responses (Rimmele, Seller, Ehlert & Heinrichs, 2009). The groups were subjected to repeated measures including test of salivary cortisol, heart rate and psychological responses. Elite sportsmen exhibited

significantly lower cortisol, heart rate, and state anxiety responses compared with untrained subjects.

A very large US study (sample n = 175,850) examined associations between levels of PA and health-related quality of life (HRQOL), including stress and depression (Brown, Balluz, Heath, Moriarty, Ford, Giles et al., 2003) Respondents were categorised into two groups by a demarcation point of 14 days or more of reported poor mental or physical health experienced in the previous 30 days which prevented them carrying out normal day-to-day activities. Although there was a large variation in the amount of PA across age groups (18-44, 45-60 and 60-plus), the proportion of people reporting 14 or more unhealthy days was significantly lower in those who were active at the recommended levels.

There was a stronger association between PA and physical ill-health than mental ill-health although the authors note that this might reflect the 'higher sensitivity and responsiveness to change' of the HRQOL measures they were using. The findings are notable because of the size of the study, but limitations include the cross-sectional design. In addition, people in the more active group were more likely to be men, white, non-Hispanic, more educated, non-smokers and non-obese; other research has also noted the clustering of health behaviours, including PA.

A cross-sectional study of 40,000 Norwegians concluded that those who take regular exercise during their free time are less likely to have symptoms of depression and anxiety. (Harvey, Hotopf, Øverland & Mykletun, 2010) but the context of the activity is important – the findings suggest that physical activity which is part of the working day does not produce the same effects, but factors such as social contact and support associated with leisure time PA are thought to be an important part of the benefits for mental health.

2.14 Cross-sectional studies on PA and stress

There have been several cross-sectional studies investigating the relationship between physical activity and perceived stress, mainly in Scandinavian or the USA, possibly because Scandinavian countries place a higher value on employees' health and well being; while in the USA, since health insurance is a cost often shared between employer and employee, there is constant pressure to reduce health risks and therefore costs. The studies have produced mixed results.

A large Swedish study into the relationship between leisure-time physical activity (LTPA) and stress (Wemme & Rosvall, 2005) hypothesised that psychosocial stressors would act as barriers to physical activity. The population studied was from the Scania Health Survey, a self-administered questionnaire on health-related behaviours, socio-demographic and psychosocial factors (response rate 59%, n= 13,715, carried out 1999-2000). The Wemme and Rosvall analysis was restricted to those in employment (52%, n= 3,877 men and 3,292 women).

Work and non-work related psychosocial stressors were included, and results indicated that several factors functioned as systematic barriers, with some gender and socio-economic differences. In particular, low LTPA was strongly associated with low levels of education and low socioeconomic status. For women, there was a weak association between work stress and low levels of LTPA, whereas work stress showed a stronger association with low LTPA for men.

In a Pearson's correlation, the study investigated the relationship between work and non-work related stress and found that these could impact on each other, but other studies had

noted that there is also an independent effect in both directions. The authors note that 'a negative job experience is less likely to be counterbalanced in leisure time by healthy activities such as physical activity.'

Non-work related stressors generally had an overall significant association with LTPA: in this particular study, low social participation was the most important, rather than work-related stress. However, since it was a cross-sectional rather than prospective study, causal factors cannot be determined.

Other studies confirm the association found in the Wemme et al. study between socio-economic position (SEP) and health-seeking behaviour such as physical activity. People with the highest levels of income, education, and job classifications more likely to engage in healthy behaviours and adopt them at a faster rate (McNeill, Kreuter and Subramanian, 2006). The McNeill review into various social determinants of physical activity also notes that 'most research has found a positive relationship between SEP and PA. Lower SEP individuals are 'more likely to report engaging in job-related physical activity and walking' while those of a higher SEP are more likely to undertake leisure-time physical activity and sport-related activity (Ford, Merritt, Heath, Powell, Washburn, Kriska et al., (1991), cited in McNeill et al., 2006). SEP is also a factor in the wider determinants of health, as evidenced by a large body of literature since the Middle Ages to the present, showing that 'occupational status, income and educational attainment predict a diverse array of diseases', with those on lower incomes experiencing poorer health and premature mortality (Mathews, Raikkonen, Everson, Flory, Marco, Owens et al., 2000).

Only weak associations between work conditions and health behaviours were found in a Finnish study (Lallukka, Lahteenkorva, Roos, Laaksonen, Rahkonen & Lahelma, 2003) which

looked at health behaviours, including PA, as outcomes in regression analysis of various factors including 'job demands and job control' - factors in stress levels. A finding of interest to the current investigation is that 'work fatigue was associated with physical inactivity.'

A very recent study of Danish workers concluded that physically active employees perceive less stress in their working lives and also perceive themselves as having more energy. (Hansen, Blangsted,Hansen,Søgaard & Sjøgaard, 2010). Stress levels were assessed objectively through a saliva test for cortisol concentrations, while PA was assessed using a Danish version of the IPAQ, which is subject to bias in over-reporting of PA. The population profile is similar to that of the present study – white collar workers aged 25-67 years (n= 389) with a higher proportion of women (n= 257 or 66%). There was a gender difference in this study too, with physically active men perceiving a lower level of stress than physically active women – an expected difference since the neuroendocrine stress response may be different for males and females (Taylor, 2000). However, no association was found between job control-demand (recognised as a source of work-related stress) and the degree of physical activity. The researchers recommend that office workers exposed to high job strain and inactivity carry out high-intensity physical activity to reduce stress levels.

Sports participation was inversely associated with stress and distress in a cross-sectional study amongst a Belgian population (Asztalos et al, 2009). The researchers studied associations between five different types of PA and perceived stress and distress in 1,919 participants aged 20-65, both employed and unemployed. Socio-economic status was found to have a moderating influence, since housework was associated with more stress and more distress in women with blue-collar jobs, while in young adults with white-collar jobs an inverse association between housework and distress was found. Biking to and from work

was associated with more stress in men with blue-collar jobs. As with other cross-sectional studies, however, it is not possible to determine causation.

Leisure time PA (LTPA) was found to have a strong inverse relationship with self-perceived levels of stress in an earlier investigation (Aldana, Steven, Sutton, Jacobson & Quirk, 1996) into a population of working adults in the USA who were enrolled in a health insurance programme (n= 32,229 adults with a mean age of 37.3 years; 57% of the cohort were women). Participants who took part in moderate physical activity (expenditure of 3.0 Kcal/kg per day) had half the rate of perceived stress as non-participants.

As this is a large study, the findings are noteworthy; however, limitations include the fact that the cohort was self-selected to enrol on the health insurance programme. Since North Americans from lower socio-economic groups are more likely to be without health insurance (Gallup, 2009) it is likely that the subjects in the Aldana study generally have a higher socio-economic status and higher levels of awareness of healthy behaviours. In addition, self-assessments of healthy behaviours may have been subject to over-reporting in order to reduce premium payments or to be accepted onto the program.

2.15 Physiological effects of PA and effects on mood

While it is difficult to measure changes in the brain during exercise, it has been hypothesised that the widely-acknowledged mood improvements and sense of well being after moderate or vigorous PA can arise from a combination of the release of beta-endorphins and hyperthermic changes; reduced muscle tension; increased self-esteem; sense of mastery and self-efficacy; and 'time out' from day-to-day pressures (Biddle, 2000). When PA or exercise is carried out in a group, additional benefits include the social participation aspect which was identified as an important association in the Swedish study (Wemme & Rosvall, 2005).

More recently, a key consensus conference in the USA on the neurobiology of exercise proposed that chronic physical activity 'mitigates several harmful consequences of acute exposure to stress' in several ways, including behaviour, emotion, the immune system and at neural and cellular levels (Dishman, Berthoud, Booth, Cotman, Edgerton, Fleshner et al., 2006). Some studies, however, included controlled experimental trials, indicate that anxiety states after exercise may be delayed rather than eliminated, while others found that some high-intensity exercises can increase negative moods (Biddle, 2000).

The potential moderating role of depression in physical activity is also worth considering. As noted by Mutrie (2000), prospective studies indicate that physical inactivity precedes depression. However, a study by Anderson (2003) on the motivations and reasons for women quitting physical activity and exercise found that for women with high depression scores, even having several motives did not translate into more activity, suggesting an interactive relationship.

2.16 Other possible barriers to physical activity

There is a substantial body of evidence to support the view that physical environments have a significant association with levels of PA, including access to facilities and aesthetic attributes (De Bourdeaudhuij, Sallis, & Saelens, 2003). Because the social environment can also produce opportunities to engage in particular behaviours, reduce or produce stress, and place constraints on individual choice (The Institute of Medicine, cited in McNeill, Kreuter & Subramanian, 2006), there is growing focus on the social environment as a determinant of PA.

Barriers to spontaneous and unstructured walking may vary amongst sub-groups. In a study of US college students which looked at perceived barriers to walking for transportation and recreation, and lifestyle activities such as using the stairs instead of the lift, (Dunton & Schneider, 2006) it was found that considerations of appearance and clothing may be important; for example, concern about getting sweaty and ruining nice clothes; although these findings cannot be generalised to other age groups, the study nevertheless indicates the existence of a disparate number of situational and other barriers to physical activity in everyday life.

The built environment has been cited by many as one possible determinant of the obesity epidemic (Royal Commission Study on the Urban Environment, 2005). Caballero (2007) notes that factors in the built environment likely to have a significant impact on the average BMI of populations include urban planning that promotes car use, necessitates long commutes, and restricts opportunities for walking.

In terms of the direction of effect, there is evidence that exercise has a low-to-moderate anxiety-reducing effect, and the strongest effects are shown in randomised controlled trials. Even single sessions of moderate exercise can reduce short-term physiological reactions to stress and enhance recovery from brief psychosocial stressors. (Mutrie, 2000).

In conclusion, therefore, although there is evidence indicating that physical activity can moderate the effects of emotional and mental stress, there is less research into how a stressful or anxious state can function as a barrier to undertaking exercise or physical activity at a level which is beneficial to health, and in particular whether stress in the workplace can determine the levels of physical activity.

Chapter 3: Hypothesis

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3.1 Primary hypothesis

To ascertain if there is a significant relationship between stress in a work role and an individual's level of physical activity. Assumption: the direction of the relationship is that work-related stress discourages people from being as physically active as they need to be for their health and well-being.

3.2 Secondary hypotheses

- There will be a significant difference in the amount of PA undertaken by different age groups
- There will be a significant difference in the amount of PA undertaken by men and women
- There will be a significant difference in the amount of PA undertaken by staff in different income bandings with a trend showing that as income increases, levels of PA increase
- There will be a significant difference in the amount of PA undertaken by people who report high levels of workplace stress and those who report low levels of workplace stress with a trend showing that as levels of workplace stress increase there is a decrease in the amount of PA undertaken.
- There will be a significant difference in the amount of PA undertaken by people who have family/carer commitments and those who do not.

- There will be a significant difference in the amount of PA undertaken by people who have the furthest distance to commute and those who have short distances to travel to work, including those who work at home.
- There will be a significant difference in the amount of PA undertaken by people who commute by car and by those who travel by public transport or cycle or walk to work.

The assumption is that some independent variables, for example, caring or family commitments (Carers UK, 2009) and time spent commuting (Frank, Saelens, Powell, & Chapman, 2007), will affect time available to spend on PA but not affect perceived stress levels.

In addition, gender and age differences can predict different levels of PA. Anderson (2003) reported that, in the US, women are more sedentary than men in every age group, while a later study (Azevedo, Araújo, Reichert, Siqueira, da Silva & Halla, 2007) which used several different guidelines and definitions for PA, found that gender differences persisted, with men consistently being more physically active than women.

Chapter 4: Methods

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4.1 Participants

All full- and part-time staff employed by NHS North West as at June 2010 (n=470) were invited by email to participate in an online survey. Workforce data on age, gender and payscales was also obtained from NHS North West to provide a comparison for the respondent sample.

NHS North West is the strategic health authority for the region, overseeing the work of NHS organisations across the North West. The vast majority of employees are office-based and have sedentary jobs requiring a minimal amount of physical effort.

4. 2 Research governance and ethics approval

The data collection method allowed participants complete anonymity and confidentiality; no personally identifiable details were requested and the direct link to the online questionnaire supplied in the invitation meant that email addresses were not disclosable. The Caldicott Principles (Department of Health, 1997) which set out an ethical framework for the NHS on the use of identifiable data, were consulted. The data generated by the online survey was password-protected and only accessible by the researcher. When the survey was complete, the data was downloaded onto the researcher's personal computer and analysed locally, not online.

To allow for the fact that the survey could have raised issues of concern for participants, the covering letter of invitation included contact details for the Occupational Health Service.

NHS North West's Research Governance Committee gave organisational approval to conduct the research study on September 28, 2009. The NHS National Research Ethics Service North West 12 Committee reviewed the ethical basis of the study and confirmed approval on May 20, 2010 (see Appendix....)..

4.3 Study design

The design was a cross-sectional survey which aimed to gather data on participants' levels of physical activity in the workplace and in leisure time, along with perceived levels of stress. Other variables of interest included age, gender, income levels, health status, carer commitments and distance of commuting from work all of which it was hypothesised could affect perceived levels of stress and levels of PA.

The introductory text to the question on stress outlined the Health and Safety Executive's definition of work-related stress to help ensure that respondents understood the difference between pressure and stress in the workplace, namely that pressure can be positive and a motivating factor, and can encourage better performance, but that stress can occur when pressure becomes excessive or when the employee perceives 'that the demands of their work are greater than their ability to cope....stress can also result from having too few demands, as people will become bored, feel undervalued and lack recognition.' (HSE, 2009)

The question offered respondents the choice of a six-item Likert-type Scale on the frequency of 'feeling stressed'. The issue of stress was also raised in another part of the survey; in question 9 on barriers to physical activity, 'stress' in home life and/or in working life were listed as options.

4.4 Measuring instrument

The instrument used for the study was a quantitative and qualitative online survey developed from a questionnaire taken from The British Heart Foundation's *Think Fit! guide to developing a workplace activity programme*. This questionnaire was designed to help organisations wishing to develop a workplace activity programme to gain an understanding of their employees' physical activity habits and levels of activity. (A copy of the questionnaire is attached at Appendix .....)

The questionnaire in the *Think Fit! Guide* is itself based on the internationally validated International Physical Activity Questionnaire (IPAQ) which was developed to provide common instruments that can be used to obtain internationally comparable data on health–related physical activity. It is one of the most widely-used self-report tools and is available in 'long' and 'short' forms, both of which include an assessment of walking, moderate and vigorous physical activity. The questionnaire used in this study was based on the short form, which is designed primarily for population surveillance of physical activity amongst adults aged 15-69 years (IPAQ, 2005), Sport England recommends both forms as a viable method for monitoring physical activity for populations in the age range 15-69. (Dugdill & Stratton, 2007).

It was subjected to extensive reliability and validity testing across 12 countries (14 sites) during 2000. The research suggests that this instrument is suitable for national population-based prevalence studies of participation in physical activity.

> 'The IPAQ instruments have acceptable measurement properties, at least as good as other established self-reports. Considering the diverse samples in this study, IPAQ has reasonable measurement properties for monitoring population

levels of physical activity among 18- to 65-yr-old adults in diverse settings' (Craig et al, 2003).

The age range of the populations covered by the Craig study is similar to that of NHS North West – that is, 18 – 64 years, the normal age range of the adult working population.

4.5 Piloting the questionnaire

During August 2009, the survey was piloted with a small group of staff. 14 people were invited to participate via a personal email message from the researcher. 10 people responded. All 10 began the survey and eight completed it. The email invitation asked respondents to provide comments and feedback if they wished and, in response to these, small adaptations were made to the survey questions. Users who commented found the survey easy to use and all were able to complete it within 10 minutes. Advice was also sought from the Department of Health's North West Regional Public Mental Health Lead on different validated scales of measuring well being and mental stress. In addition, the Associate Director for Human Resources at NHS North West was invited to comment on the draft questionnaire and, as a result, an amendment was made to the question on stress to include a wider range of possible responses, from four to six.

4.6 Recruitment of participants

An invitation to participate in the survey was emailed to all employees of NHS North West using the internal email directory. The email message included a direct link to the questionnaire on SurveyMonkey. (A copy of the email invitation to staff is attached at Appendix ....; information about SurveyMonkey Appendix .....).

Participation was entirely voluntary and the survey was open from June 14 until July 30, 2010. Because the fieldwork was carried out during the start of the summer season, the survey was kept open for several weeks to ensure that staff who may have been away on holiday were able to participate. Two follow-up reminders were emailed to staff at two week intervals. (see Appendix III). There were no incentives offered to take part in the survey. When the survey closed, there was a total of 186 respondents. The final response rate, after data reduction because of errors, was 37% (n=174).

4.7 Inclusion criteria

The sample was self-selected and therefore there were no pre-determined exclusion or inclusion criteria, except for the fact of being an employee of NHS North West during the period of the survey.

4.8 Data analysis

All analysis was conducted using SPSS v. 16.0 for Windows. The levels of data include nominal, ordinal and interval levels, as well as Likert Scale responses (for example, the stress scores) although these are considered to be interval level data.

4.9 Primary outcome measure

The primary outcome measures were (i) the amount of physical activity undertaken in the last seven days (recalled) and (ii) the levels of self-reported work related stress. Physical activity (PA) scores and stress scores were used to investigate correlation. Using IPAQ scoring guidance, physical activity levels were scored as 'low, moderate or high'. The METS compendium (Ainsworth, 2002), the World Health Organisation guidelines on physical

activity (2004) and the American College of Sports Medicine position stand (2009) were also consulted for comparison.

Variables related to the secondary hypothesis

- Age
- General health
- Long-term health conditions
- Gender
- Job grading
- Caring responsibilities
- Physical effort demanded by job role
- Commuting distance

The survey instrument assesses physical activity within and outside work including activity such as purposeful walking and how sedentary the occupation is.

Estimates of the domains of physical activity used in the survey are based on the guidelines and scoring protocol developed for the IPAQ, which sets out the following four categories

- leisure time physical activity
- household, gardening and 'DIY' activities
- work-related physical activity
- transport-related physical activity

A MET is defined as 1 kcal/kg/hour and is roughly equivalent to the energy cost of sitting quietly (Ainsworth, Haskell, Whitt, Irwin, Swartz, Strath et al., 2000). A MET also is defined as oxygen uptake in ml/kg/min with one MET equal to the oxygen cost of sitting quietly, equivalent to 3.5 ml/kg/min.

Energy expenditure in MET-minutes, MET-hours, kcal, or kcal per kilogram body weight can be estimated for specific activities by type or MET intensity. Clearly, for accurate

calculations of energy expenditure for any particular individual undertaking a specific activity, a wide range of factors needs to be taken into account, including bodyweight in Kg, age, gender, and ratio of lean to fat mass, so there can be wide variations from person to person. 'The true energy cost for a person may or may not be close to the stated mean MET level as presented in the Compendium' (Ainsworth et al., 2000).

4.10 Statistical analysis

The main research aim was to investigate the degree of the relationship among variables

Table 4.1 Summary of variables and aim of investigation

Number of dependent variables	Two: stress and physical activity
Number of independent variables	Multiple
Analytic techniques	Bivariate correlations One Way Independent Groups (ANOVA) Multiple regression
Goal of analysis	Create a linear combination of IVs to predict DV optimally
Assumptions of statistical techniques	• ratio scale used for measuring time spent on PA (minutes) • time spent on PA is normally distributed • equal variance in time spent on PA across different groups

4.11 Coding of responses for dependent variables

Data was exported from SurveyMonkey as an Excel spreadsheet and recoded for importing into SPSS.

Physical activity: Both categorical and continuous indicators of physical activity are possible from the IPAQ form (IPAQ, 2005) on which the questionnaire was based. Two scores for PA were used: (1) a continuous variable of the total number of MET-mins/week

calculated by adding minutes of purposeful walking, minutes of household and gardening activities and minutes of sport and exercise; and (2) a categorical variable obtained by assigning each MET-mins/week total into the following categories.

- **Low category (coded as 1)**

  This is the lowest level of physical activity and cases who did not meet criteria for categories 2 or 3 scored as 1.

- **Moderate category (coded as 2)**

  Any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 600 MET-min/week.

- **High category (coded as 3)**

  Any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3,000 MET-minutes/week

Continuous score analysis

Because of the wide range within categories ('moderate' ranges from 600 MET-min/week to 2,999 MET-mins/week), analysis was also carried out using the total MET-mins/week for each case to give a more complete picture. The questionnaire also included opportunities for free text - this has been subjected to qualitative analysis.

Stress levels: these were coded to align with the six options in the questionnaire as follows:

- I hardly ever feel stressed 1
- I feel stressed about once a month 2
- I feel stressed about once a fortnight 3
- I feel stressed once or twice a week 4
- I feel stressed some days each week 5
- I feel stressed almost all the time 6

For additional testing purposes, stress scores were also grouped into three categories as follows: Scores 1 and 2 = Low; Scores 3 and 4 = Moderate; Scores 5 and 6 = High.

4.12 Coding of responses for dependent variables

For the covariates to be tested in the secondary hypotheses, the coding was as follows:

Table 4.2 Coding scheme for covariates

<table>
<tr><th colspan="3">Covariates which had more than two groupings</th></tr>
<tr><td>Age bands
Under 21= 1
21-30 = 2
31-40 = 3
41-50 = 4
51-60 = 5
60 plus = 6</td><td>Job bands
Band 3 = 1
Band 4 = 2
Band 5 = 3
Band 6 = 4
Band 7 = 5
Band 8a = 6
Band 8b = 7
Band 8c = 8
Band 8d = 9
Band 9 = 10
Very senior manager = 11</td><td>Commuting distance
Under 1 mile = 1
1-5 miles = 2
11-19 miles = 4
20 miles or more = 5</td></tr>
<tr><td>Sedentary nature of work
Mostly sitting = 1
Mostly standing = 2
Mostly walking about = 3</td><td rowspan="2">General health
Poor = 1
Fair = 2
Good = 3
Very good = 4
Excellent = 5</td><td rowspan="2">Intentions re PA
Not interested in becoming more active = 1
Have recently been thinking about becoming more active = 2
Am intending to become more active = 3
Have recently become regularly active = 4
Have been regularly active for at least six months = 5</td></tr>
<tr><td>Physical effort at work
Not very demanding = 1
Fairly demanding = 2
Very demanding = 3</td></tr>
</table>

For binary covariates (e.g. male/female) or perceived barriers to PA (e.g. injured/not injured), responses were coded 0 or 1.

Following an initial analysis, 10 cases were excluded from the final analysis because of obvious errors in mis-reporting PA levels (such as reporting a weekly activity total of 10

hours walking, gardening or sports participation as a daily activity total). The final number of cases analysed was 174.

Chapter 5: Results

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Characteristics of the sample

Table 5.1 shows the demographics and physical activity characteristics of the sample. All variables are self-reported.

Table 5.1: Demographics and physical activity characteristics. Total n = 174

Characteristics of the sample		%	N	missing data
Gender	Women	77.8	137	
	Men	19.9	35	
				2.3%
Age	21-30	17.6	31	
	31-40	29.5	52	
	41-50	22.2	39	
	51-60	26.1	46	
	60-plus	2.8	5	
				1.7%
Job banding	3	2.3	4	
	4	23.3	41	
	5	14.8	26	
	6	10.8	19	
	7	11.9	21	
	8a	19.8	19	
	8b	5.1	9	
	8c	8.5	15	
	8d	2.3	4	
	9	4.0	7	
	VSM	2.8	5	
				3.4%
Sedentary work	Mainly sitting down	96%	169	
	Mainly standing	0.6%	1	
	Mainly walking about	0.6%	1	
				2.8%
Lifestyle activity	Use public transport to work	64%	114	
	Cycle to work	5.1%	9	

Data in *Table 5.1* show that over three-quarters of the group (77%) are women, which is a bigger proportion than in the total population of SHA staff (66%). The proportion of men in the sample (19.9%) is smaller than in the total population of SHA staff (34%). The range of job bandings in the sample is similar to that in the wider SHA staff population (data not shown), within two or three percentage points, except for band 8a, where the proportion in the study sample is 19.8% and in the wider group is 7%. Figures for numbers of staff on the very senior management (VSM) banding in the wider staff group are not available. The vast majority of staff in the sample (96%) reported that they spend most of the day sitting. Approximately two thirds of the sample (64%) use public transport for commuting to work and 5% cycle, but there are no figures available on the commuting methods used in the overall SHA staff group.

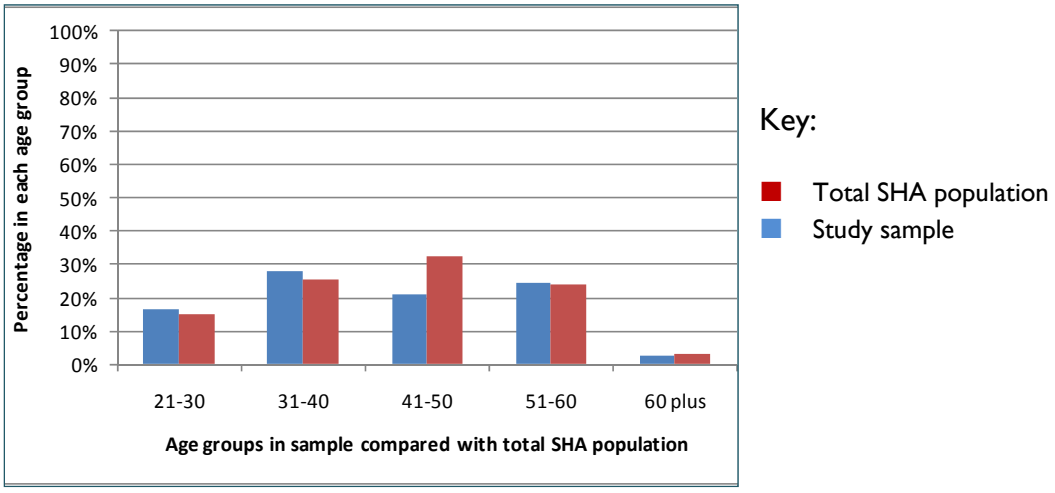

Figure 5.1 Analysis of age groupings in sample compared with potential total population of respondents in staff of NHS North West, the strategic health authority (SHA).

In *Figure 5.1* there is a comparison of age groupings in the study sample compared with the age groups in the wider SHA staff group. The proportions in the sample are similar to the proportions in the wider group, except for the age band 41-50, where the study sample is more than 10 percentage points smaller.

Results: main hypothesis

Across the total sample, it was found that those being more physically active had lower rates of self-reported stress (*Figures 5.2* and *5.3*). Mean MET-mins/wk were as follows, with the standard error shown in brackets. For the whole sample the figure was 2240(1640), for low activity 409(139), for moderate activity 1589(625) and for high activity 4607 (1402).

Mean stress scores were as follows (range 1-6) with the standard error figure in brackets. The figure for the whole sample was 3.31 (1.62), for the low activity group 4.5 (1.22), for the moderate activity group 3.35 (1.6) and for the high activity group 2.81 (1.63).

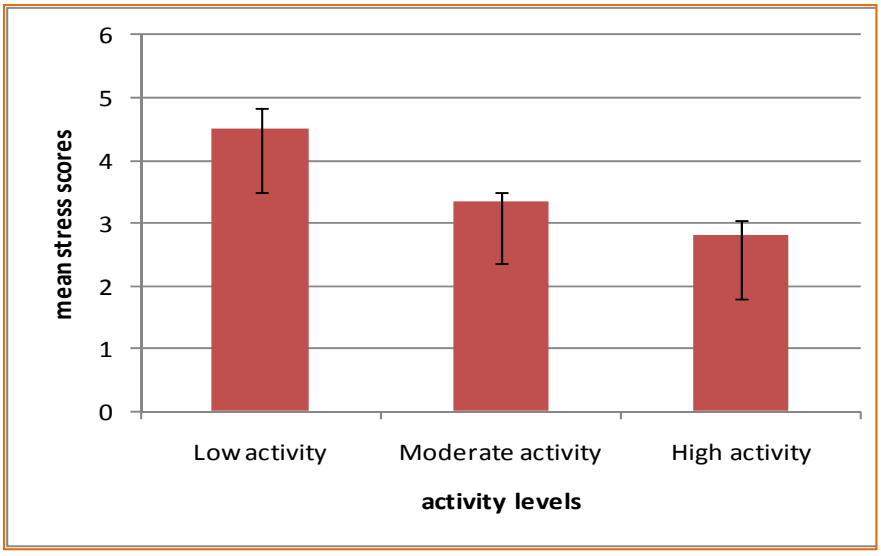

Figure 5.2. Mean stress scores and activity categories for the whole sample, showing that the low activity group has the highest mean stress score

Among all respondents, 8% (n=14) were in the 'low' category of physical activity (less than 600 MET-mins/week) and of those, 64.3% (n=9) were identified as having a high score (5 or 6) on the stress scale. Among all respondents, 66% (n=116) were classified as being moderately active (achieving at least 600 MET-mins/week) and of those, 31% (n=36) were identified as having a high score (5 or 6) on the stress scale. Among all respondents, 24.7%

(n=43) were in the 'high' category (achieving at least 3,000 MET-mins/wk) and of those, 20% (n=9) were identified as having a high score (5 or 6) on the stress scale. The mean value (p = 0.03) for the stress scores was

- 4.50 (SD:1.22) for the low activity group,
- 3.35 (SD:1.60) for the moderate activity group; and
- 2.81 (SD:1.63) for the high activity group

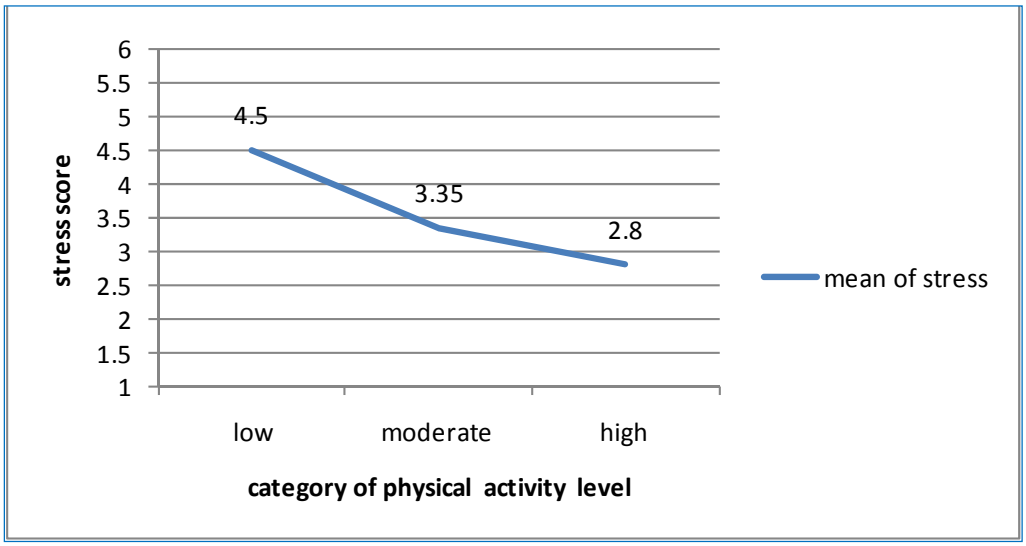

Figure 5.3 Mean of activity levels (x) plotted against mean of stress levels (y) showing a strong negative association: stress levels decrease as activity levels increase with most benefit derived when moving from low to moderate activity levels.

The graph in *Figure 5.3* shows means of stress and means of activity levels (ordinal level data). Results suggest a negative correlation: as activity levels increase, stress levels decrease. The mean difference in stress scores between the low-activity and moderate activity groups was 1.14 (SE: 0.45) (p = 0.01) and the mean difference in stress scores between low-activity and high activity groups was 1.68 (SE: 0.48) (p = 0.00). However, there was no significant difference between the moderate- and high-activity groups.

In the low stress group, there were 61 cases, with a mean MET-mins/wk of 2751(SE: 238); in the moderate stress group, there were 59 cases with a mean MET-mins/wk of 2026 (SE:

162); and in the high stress group, there were 53 cases with a mean MET-mins/wk of 1893 (SE: 229) (*Figure* 5.4). There was a significant difference between the groups (p = 0.00).

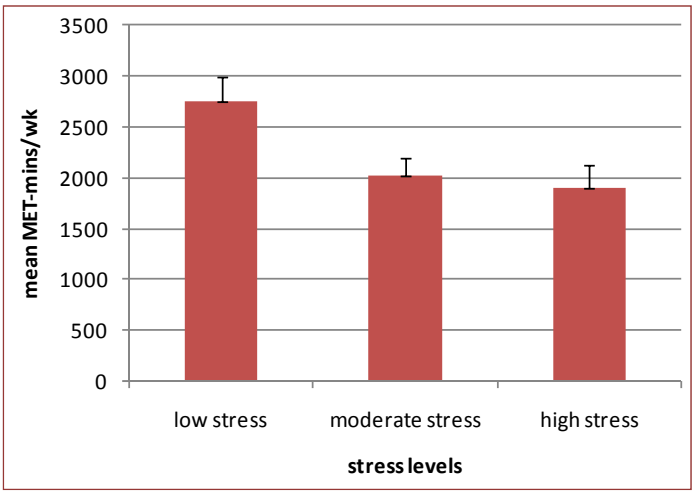

Figure 5.4 Mean MET-mins/wk by low, moderate and high stress groups

The significant difference lay (p = 0.01) between the low stress group and the moderate stress group; there was also a significant difference (p = 0.00) between the low stress group and the high stress group .

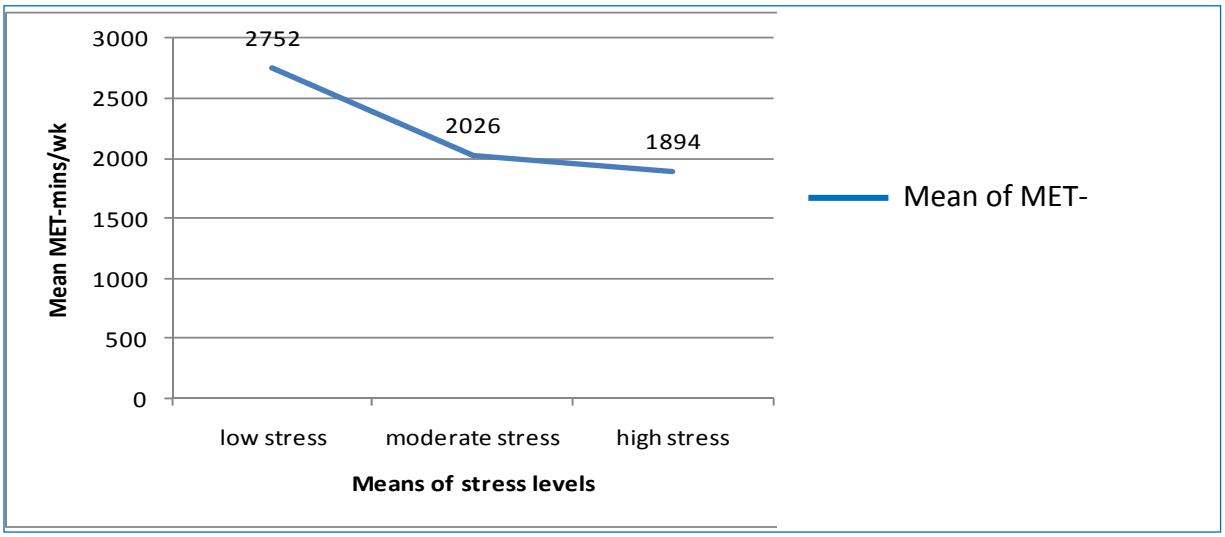

Figure 5.5 Graph with mean MET-mins/wk for three groups – low, moderate and high stress levels. Indicating that benefits in reduced stress levels can be achieved by only a modest increase in activity levels.

The graph in *Figure 5.5* suggests that only a relatively small increase in levels of PA is needed to show an association with lower levels of stress, previously observed in other studies

(Schnohr et al., 2005) but the specific 'cause and effect' mechanisms have not been identified.

Secondary hypothesis: age

There will be a significant difference in the amount of PA undertaken by different age groups.

Table 5.2 shows the mean stress scores and MET-mins/wk by age group. There was a significant difference (p= <0.02) between activity levels of age groups but not in stress levels (p = 0.42). There was a significant difference between age group 21-30 years and age group 51-60 years (mean difference in MET-mins/wk 918 [SE:375]) (p = 0.01); and between age groups 31-40 years and 51-60 (mean difference in MET-mins/wk 1006 [SE: 326]) (p = 0.00).

Table 5.2 Mean stress scores and mean MET-mins/wk by age group

Age group	Mean MET-mins/wk (SE)	Mean stress scores (SE)
21-30	1976 (224)	3.55 (0.27)
31-40	1914 (202)	3.52 (0.24)
41-50	2236 (258)	3.15 (0.25)
51-60	2943 (298)	3.07 (0.23)
60-plus	1470 (220)	2.6 (0.81)

Figures 5.6 and *5.7* illustrate the results of the analysis of age, activity levels and stress levels. Figure 5.6 shows that the group with the highest levels of PA a week was the 51-60 age group (mean MET-mins/wk of 2894) and the group with the lowest level of activity was the 60-plus age group. There was very little difference between the levels of activity in the 21-30 age group and the 31-40 age group (means of 1976 [SE: 22.4] and means of 1914 [SE: 202]).

There was no significant difference in stress levels between the age groups, although there was a trend for stress levels to decrease with age. Stress levels were the highest, and very similar, across the two age groups 21- 30 (2.55) and 31- 40 (3.52).

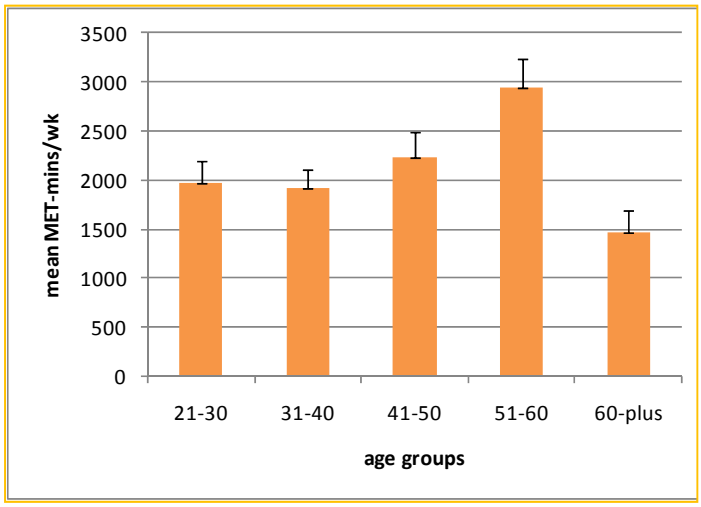

Figure 5.6 Means of total MET-mins/wk by age groups showing the highest levels of activity in the 51-60 year age group and the lowest in the 60-plus age group

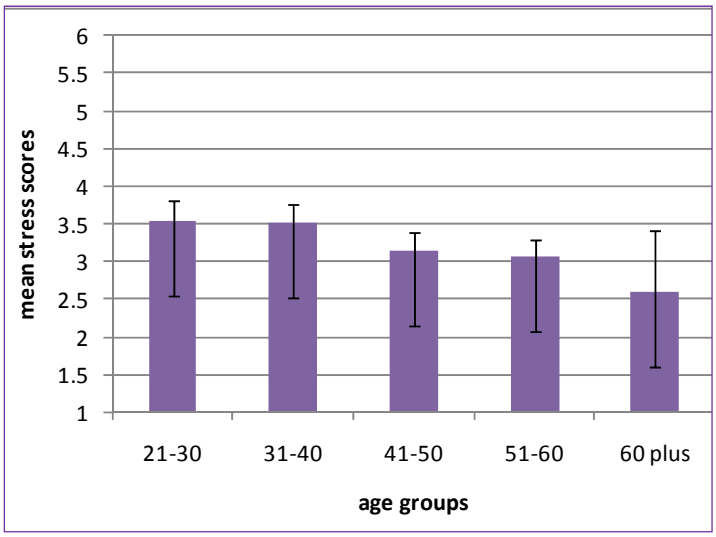

Figure 5.7 Means of stress scores by age groups showing the lowest levels of stress amongst the 60-plus age group. The lowest score for stress was 1 and the highest was 6.

Secondary hypothesis: gender

There will be a significant difference in the amount of PA undertaken by men and women.

Results of the analysis, shown in *Figure 5.8* and *Figure 5.9*, indicate that while men have slightly higher activity levels than women (2255 [SE: 1832] for men, and 2254 [SE: 1600] for women), there is no significant difference ($p = 0.97$); however, there is a larger error margin for the men's data. Mean stress levels for men were also slightly higher (3.49 [SE: 1.44]) than for women (3.25 [SE:1.66]) but again, there is no significant difference ($p = 0.44$).

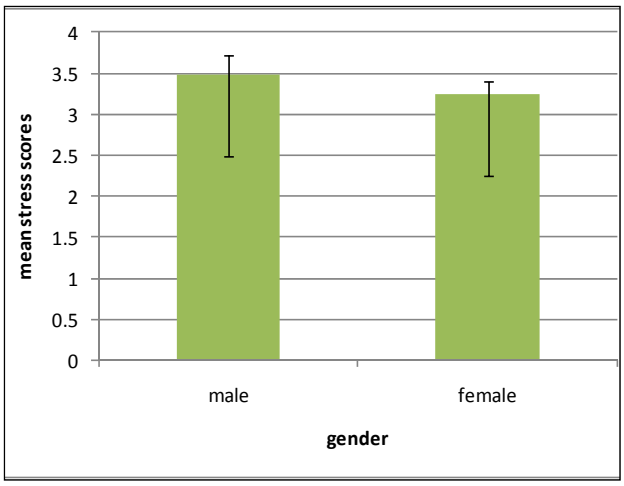

Figure 5.8 Means of stress scores by gender showing that the women in this sample have a slightly lower mean score for stress levels than men.

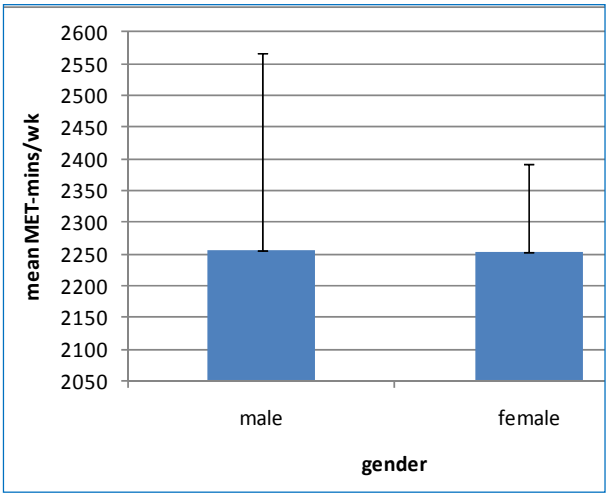

Figure 5.9 Means of MET-mins/wk by gender showing that the men and women in this sample have almost identical scores although the error margin for the male group is much wider.

Secondary hypothesis: job/income bands

There will be a significant difference in the amount of PA undertaken by staff in different income bandings with a trend showing that as income increases, levels of PA increase.

Results showed there was a significant difference (p = 0.03) between groups in levels of physical activity.

Table 5.3 Mean of Met-mins/wk by job banding.

Job banding	MET-mins	SE
band3	1328	258
band4	1951	166
band5	2433	363
band6	3123	424
band7	2121	350
band8a	2701	450
band8b	1999	507
band8c	1270	222
band8d	1261	381
band9	2469	903
VSM	3141	1355

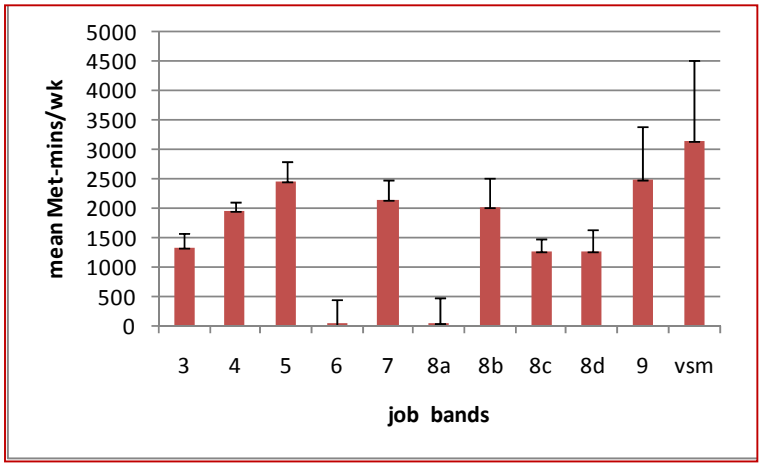

Figure 5.10 Mean Met-mins/wk by job banding indicating that the highest activity levels are found in the highest job category ('very senior manager')

Post hoc analyses (LSD) found significant differences in MET-mins/wk between the following job bandings:

- Band 3 and Band 6 : mean difference 1795 [SE: 888] (p = 0.04)
- Band 5 and Band 8c: mean difference 1163 [SE: 523.82] (p = 0.02)
- Band 8a and Band 8c : mean difference 1431 [SE: 558.01]) (p = 0.01)
- Band 8c and VSM : mean difference 1871 [SE: 834.28] (p = 0.02)

The lowest mean scores for stress and highest mean levels of activity are found in the VSM banding, but there was no significant difference between groups in stress levels (p = 0.36). There is no overall pattern of association in the range of scores for other job bandings *(Figure 5.10* and *Figure 5.11*).

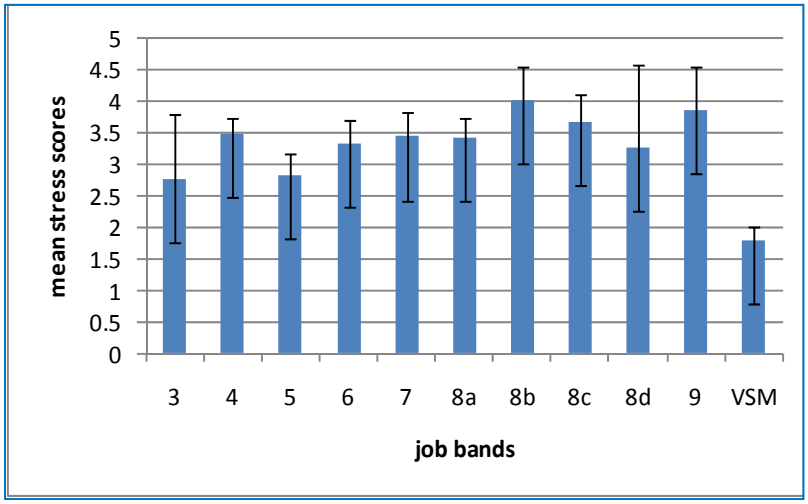

Figure 5.11 Mean stress scores by job banding indicating that the lowest stress scores are found in the highest job category, 'very senior manager' (VSM).

A Spearman's *r* was conducted on the variables of MET-mins/wk., job bandings and stress scores, with correlation being significant at 0.01. There was a correlation coefficient of 0.20 (p = 0.00) between stress and MET-mins/wk., a low correlation as suggested by Cohen & Holliday (1996). There was no significant correlation (p = 0.5) between job band and MET-mins/wk or between job band and stress (p = 0.6).

Secondary hypothesis: Carer/family commitments

There will be a significant difference in the amount of PA undertaken by people who have family/carer commitments and those who do not.

The group reporting carer commitments was smaller (n = 53) than the non-carer group (n = 121). Mean MET-mins/wk for the carer group was 2231 (SE: 251) and for the non-carer group 2241 (SE: 141) (*Figures 5.12* and *5.13*).

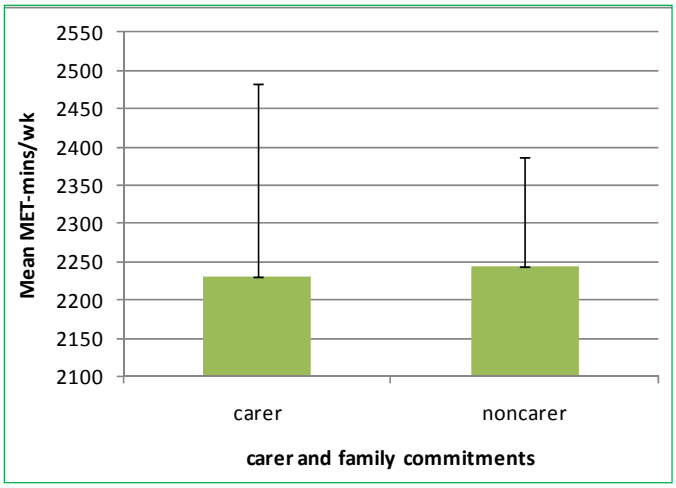

Figure 5.12 Mean MET-mins/wk by caring status showing that there is a very small difference in activity levels between the two groups, although people who do not report carer commitments achieve a slightly higher level of activity

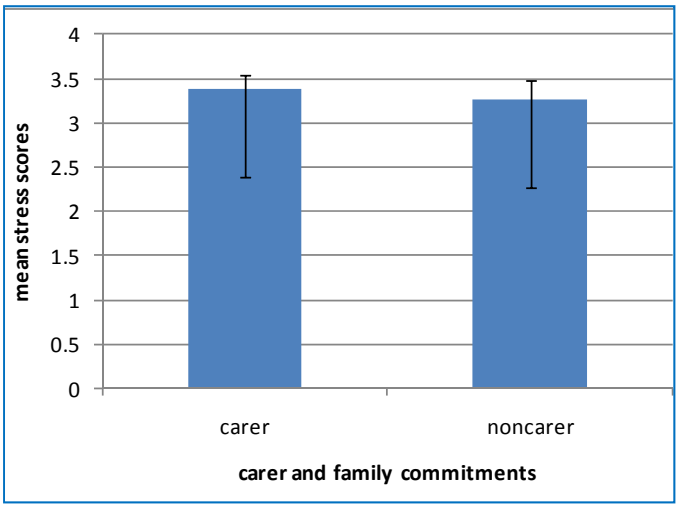

Figure 5.13 Mean stress scores of carer and non-carer groups indicating that people with carer or family commitments report a slightly higher level of stress than those without.

Mean stress levels for the carer group were 3.4 (SE: 0.2) and for the non-carer group 3.3 (SE: 0.1). There was no significant difference in MET-mins/wk between the two groups (p = 0.9) or in stress levels (p = 0.6).

Secondary hypothesis: Commuting distance

There will be a significant difference in the amount of PA undertaken by people who have the furthest distance to commute and those who have short distances to travel to work, including those who work at home.

Figures 5.14 and *5.15* illustrate the results of the analysis of groups by commuting distance.

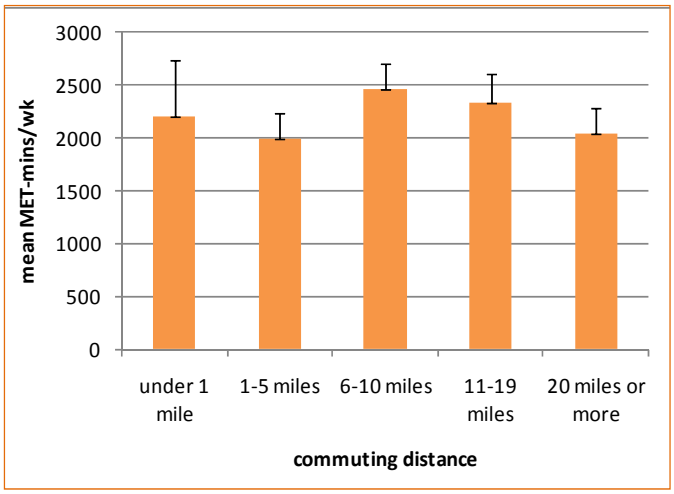

Figure 5.14 Mean MET-mins/wk by commuting distance showing the highest score in the group which commutes 6-10 miles.

There was no significant difference between the groups in levels of physical activity (p = 0.6) or stress levels (p = 0.4). A further analysis was run for those who mainly work from home, as this could affect both PA levels and work-related stress. However, there was no significant difference (p = 0.6) in levels of PA: mean MET-mins/wk for those who work from home (n = 8) was 1963 [SE: 447] while for office-based workers the mean was 2245 [SE: 129]. In addition, there was no significant difference (p = 01) in mean stress levels between home-based staff (1.5) and others (1.9).

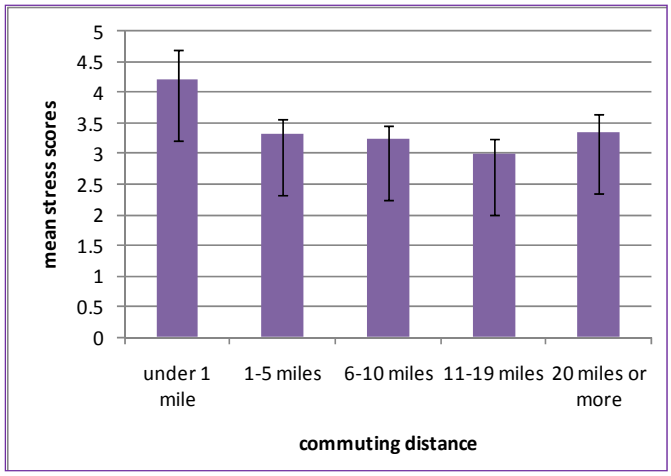

Figure 5.15 Mean stress scores by commuting distance showing that the group who have the least distance to travel have the highest stress scores.

Secondary hypothesis: transport methods

There will be a significant difference in the amount of PA undertaken by people who commute by car and those who travel by public transport or cycle or walk to work.

There was no significant difference (p = 0.5) between the group who commute by car and those who use other methods of transport such as public transport or cycling; mean MET-mins/wk for car users (n= 79) was 2321 (SE: 193) and for others (n = 95) was 2158 (SE: 163), as shown in *Figure 5.16*.

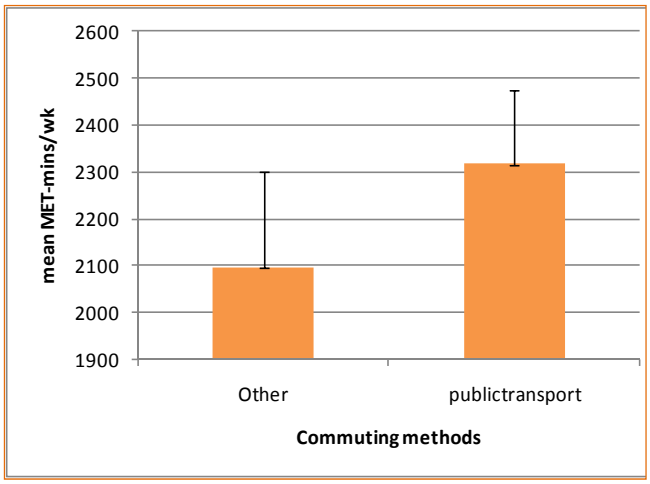

Figure 5.16 Mean MET-mins/wk by commuting method showing that the group who use public transport report a higher level of PA than those who commute by other methods (car).

Barriers to PA

Previous research indicated that factors such as the built environment, levels of education, sociodemographic status, access to public transport and availability of recreational facilities can all play a role in the amount of PA undertaken amongst populations (De Bourdeaudhuij et al., 2002, Dunton et al., 2006, Huston et al., 2003).

The survey in this study attempted to identify self-perceived barriers to PA, since these might function as confounding variables in correlations between stress and PA. The survey offered respondents a list of possible options, namely: **"**injury**;** poor health**;** distance to facilities**;** dislike of sport/exercise**;** family/carer commitments**;** work commitments**;** low level of energy**;** high level of personal stress**;** high level of work stress; lack of transport; cost of facilities; no-one to do it with; not aware of facilities/classes; not available when I can attend." The final option ("Other") provided for free text which is analysed in the 'Qualitative' section.

Table 5.4: Descriptive statistics for self-reported barriers to PA

Barriers	**% of respondents**	**N**
Injury	12.8	18
Poor health	3.5	5
Distance to facilities	13.5	19
Dislike sport/exercise	9.9	14
Family/carer commitments	41.8	59
Work commitments	46.8	66
Low level of energy	2.1	41
High level of personal stress	10.6	15
High level of work stress	9.2	13
Lack of transport	7.8	11
Cost of facilities	28.4	40
No-one to do it with	10.6	15
Not aware of facilities/classes	4.3	6
Not available when I can attend	9.9	14
Other		27
TOTAL		**141**

Analysis was carried out with each of the covariates listed in *Table 5.4*.

Injury as a perceived barrier to PA

Sixteen respondents reported injury as a reason for not undertaking more PA. Mean MET-mins/wk for this group was 2607 (SE: 460) while for those who did not report injury as a barrier (n = 158) mean MET-mins/wk was lower at 2203 (SE: 128). However, there was no significant difference in means between the two groups (p = 0.3) but means for both groups fell into the 'moderate activity level' category of at least 600 MET-mins/wk (*Figure 5.17*).

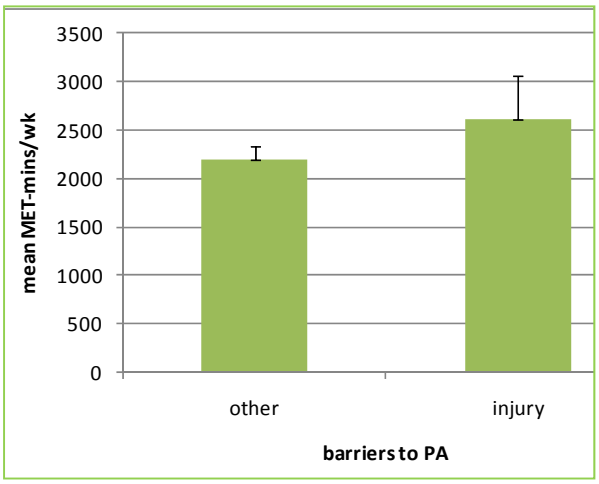

Figure 5.17 Mean MET-mins/wk for groups reporting injury and those not reporting injury showing that those who cited injury as a barrier reported higher levels of PA than those who did not.

Health status as a perceived barrier to PA

Since health status is an important covariant for both stress and PA, this was examined in two different questions in the survey. In one question, respondents were asked to indicate their health status from one of five options: (1) Very poor; (2) Poor; (3) Fair; (4) Good; (5) Very good. These numbers also relate to the coding in the data analysis. No-one reported health status as 'very poor' so in this sample there were only four groups. Over three quarters of the sample in total reported their health as 'good' or very good ('good' n = 90 or 51% and 'very good' = 42 or 24%), while 35 people reported their health as 'fair and 5 as 'poor'.

The mean-MET mins/wk by health status is (standard error in brackets):

- Poor: 1438 (SE: 538)
- Fair : 1874 (SE:283)
- Good: 2141 (SE:152)
- Very good: 2877 (SE: 298)

The chart in *Figure 5.18* shows there is a clear trend for MET-mins/wk to increase with self-reported good health. In *Figure 5.19* a graph plotting means of MET-mins/wk (y) against health status (x) confirms the trend.

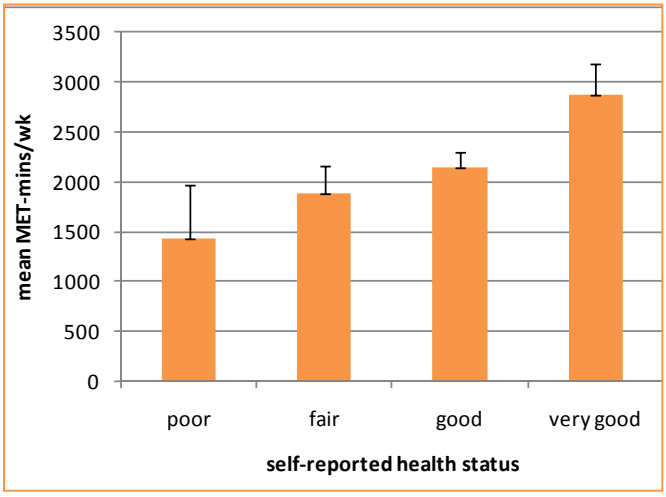

Figure 5.18 Mean MET-mins/wk by self-reported health status indicating that the highest amount of PA is found in the group with 'very good' health.

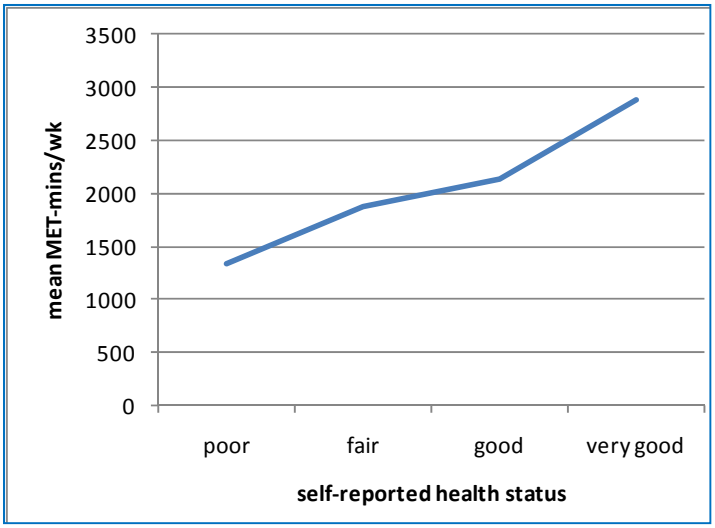

Figure 5.19 Means of MET-mins/wk by self-reported health status with a clear trend showing that increased levels of PA are associated with self-reported good health.

There was a significant difference between the groups (p = 0.02). A post-hoc analysis (LSD), with the alpha level set at 0.05, showed there were significant differences in mean PA levels between the group reporting 'fair' and that reporting 'very good' health (p = 0.00); and between the group reporting 'good' and that reporting 'very good' health (p = 0.01). An expected significant difference between the 'poor health' groups and the 'good' and 'very good' health groups was not found, but the group reporting poor health is very small (n = 5), and the difference between the 'poor' and 'very good' health groups was tending towards significant at p = 0.06.

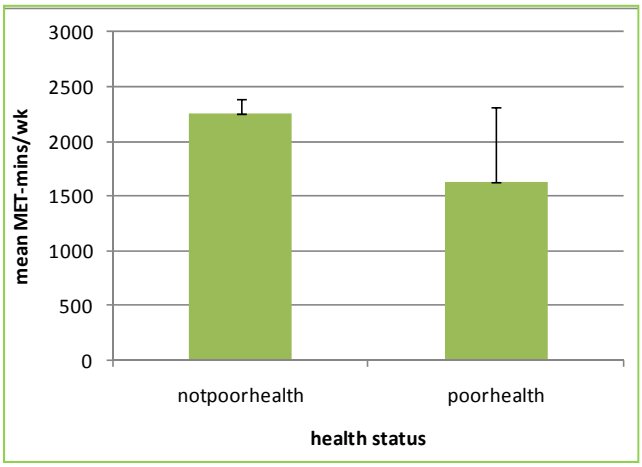

Figure 5.20 Mean MET-mins/wk in two groups, one of which reported 'poor health' as one of the perceived barriers to PA, and one of which did not.

In the question on perceived barriers to PA, poor health was one of the options (*Figure 5.20*). Only a small number (n = 5) ticked this option. Mean MET-mins/wk for this group was 1630 (SE: 687) compared with the group who did not tick this option (n = 169), where mean MET-mins/wk was 2258 (SE: 126), There was no significant difference (p = 0.4) between the groups.

Health status and stress levels

There was a significant difference in reported stress between the groups by health status (p = 0.0). A post hoc analysis showed that there was significant difference in mean stress levels between the group with poor health and the three other groups: the group with fair health (p = 0.02), with good health (p = 0.00) and with very good health (p = 0.00).

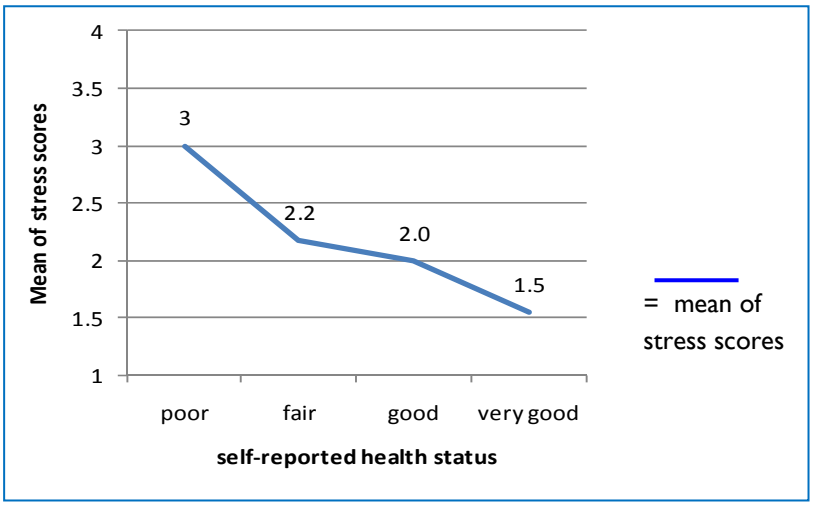

Figure 5.21 Self-reported health status and means of stress levels showing that as health status improves, stress levels tend to decline

Because previous studies (Mathews et al., 2000) have indicated that an important covariant of health, stress levels and PA is socio-economic position (SEP), further analysis was carried out on job bandings (as a proxy for income levels) and health status. The difference was tending towards significance (p = 0.06) showing that people in higher job bands tend to experience better health (*Figure 5.22*).

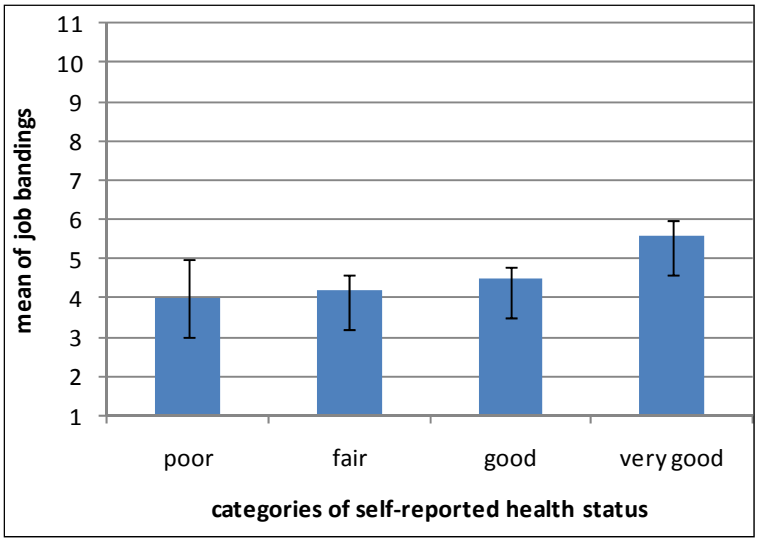

Figure 5.22 Self-reported health status and means of job banding (range of scores was 1-11) showing that good health tends to increase with higher income levels.

Distance to facilities as a perceived barrier to PA

Mean MET-mins/wk in the group citing distance to facilities as a barrier to PA (n = 19) was 2281 (SE: 369) while for the other group (n= 155), mean MET-mins/wk was 2226 (SE: 133), with no significant difference (p = 0.89). *Figure 5.21* illustrates that despite perceiving distance to facilities as a barrier, this group nonetheless has a higher mean of PA a week than the group who did not perceive the distance as a barrier.

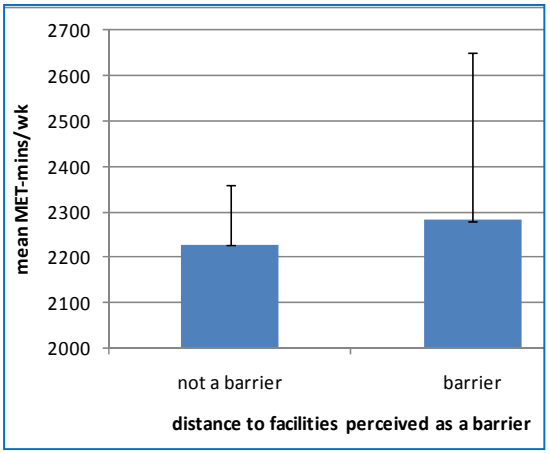

Figure 5.23 Mean MET-mins/wk in two groups, one of which reported 'distance to facilities' as a barrier to PA and one which did not.

Dislike of sport / exercise as a perceived barrier to PA

Mean MET-mins/wk reported by respondents who cited dislike of sports / exercise as a barrier (n = 14) was 2199 (SE: 452) compared with mean MET-mins/wk of 223 (SE: 130) for those who did not report this as a barrier (n = 160). However, there was no significant difference in means between the group (p = 0.9) (*Figure 5.22*).

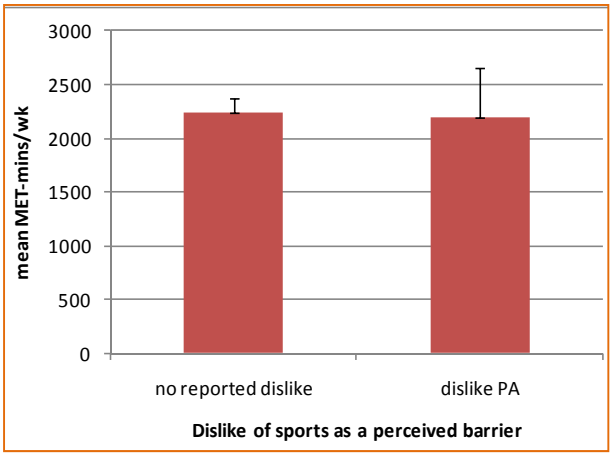

Figure 5.24 Mean MET-mins/wk in two groups, one of which reported 'dislike of sports / exercise' as a perceived barrier to PA and one which did not.

Low levels of energy as a perceived barrier to PA

Mean MET-mins/wk of the group who reported low levels of energy as a barrier to PA (n = 38) was 2304 (SE: 292) compared with mean MET-mins/wk of 2212 (SE: 137) for those who did not report this as a barrier (n = 136). However, there was no significant difference in means between the groups (p = 0.76). An expected difference was that the group *not* reporting low levels of energy would have a higher mean level of PA but in fact the group reporting low levels of energy had a higher mean (*Figure 5.23*) level of PA.

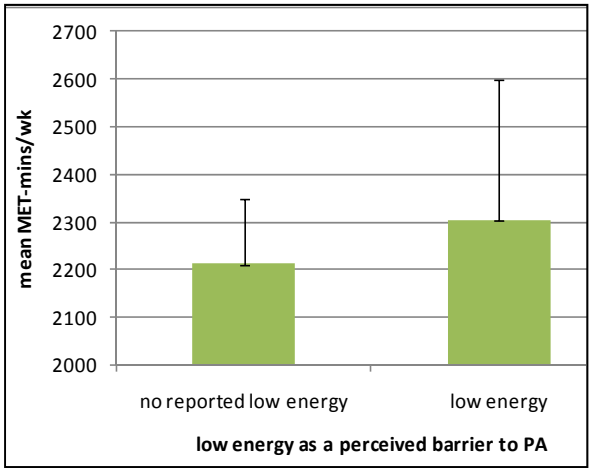

Figure 5.25 Mean MET-mins/wk in two groups, one of which reported 'low energy' as a perceived barrier to PA, and one which did not showing that the 'low energy' group had a higher mean MET-ins/wk.

Work commitments as a perceived barrier to PA

Mean MET-mins/wk of the group who reported work commitments as a barrier (n = 62) was 2548 (SE: 239) compared with mean MET-mins/wk of 2057(SE: 139) for those who did not report this as a barrier (n = 112). An expected difference was that the group who did not report work commitments as a barrier would have a higher mean score but in fact (*Figure 5.24*) the group reporting work commitments as a barrier had a higher mean score (p = 0.06) which is tending towards significance.

Figure 5.26 Mean MET-mins/wk in two groups, one of which reported 'work commitments' as a perceived barrier to PA, and one which did not showing the group which perceived work commitments as a barrier has a higher mean score for MET-mins/wk.

Work-related stress as a perceived barrier to PA

Figure 5.27 Mean MET-mins/wk in two groups, one of which reported 'work-related stress' as a perceived barrier to PA, and one which did not.

Fourteen respondents were found to have reported work-related stress as a perceived barrier to being more active. This group had a mean MET-mins/wk of 1965 (SE: 388) while the group who did not report work-related stress as a barrier (n = 162) had a higher mean MET-mins/wk score of 2252 (SE: 131) (see *Figure 5.25*). However, there was no significant difference between the groups (p = 0.5).

Personal stress as a perceived barrier to PA

Fourteen respondents were found to have reported personal-related stress as a perceived barrier to being more active. Although the number of cases was the same as in the group reporting work-related stress, only four subjects were in both groups. The group reporting personal stress had a higher mean MET-mins/wk than the other group (*Figure 5.25*): the 'personal stress' group mean was 2688 [SE: 441] and the other group mean was 2190 [SE: 131].There was no significant difference between the groups (p = 0.3).

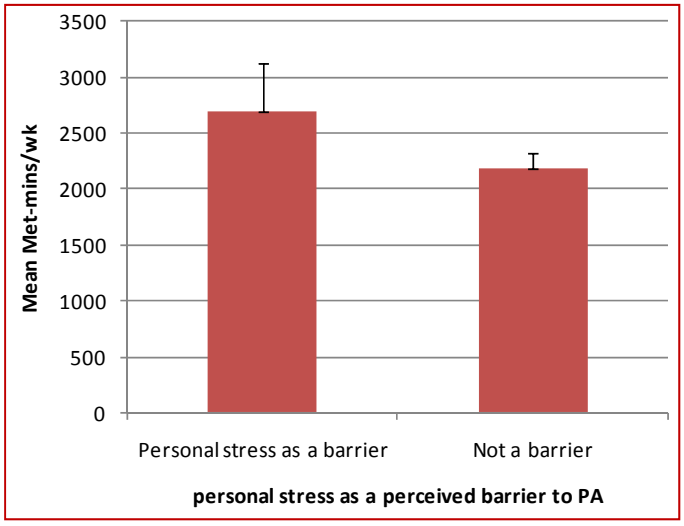

Figure 5.28 Mean MET-mins/wk in two groups, one of which reported 'personal stress' as a perceived barrier to PA, and one which did not.

Lack of transport as a perceived barrier to PA

The group indicating a lack of transport as a perceived barrier to PA (n = 10) had a mean score for MET-mins/week of 2547 (SE: 602) which is higher than the mean MET-mins score for the group who did not report lack of transport as a perceived barrier (n = 164) of 2213 (SE: 127) as illustrated in *Figure 5.26*. There was no significant difference between the two groups (p = 0.5).

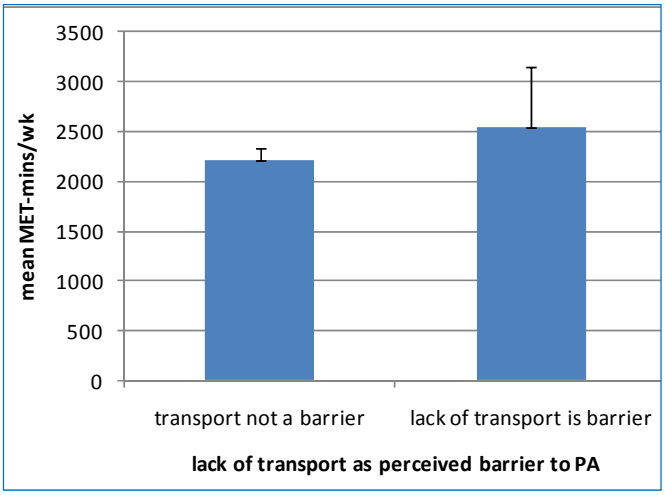

Figure 5.29 Mean MET-mins/wk in two groups, one of which reported 'lack of transport' as a perceived barrier to PA, and one which did not, showing a higher level of PA amongst the first group.

Cost of facilities as a perceived barrier to PA

The group indicating that cost was a perceived barrier to PA (n = 40) had a mean MET-mins/wk score of 1944 (SE:197) while the other group (n = 134) had a mean MET-mins/wk score of 2318. (SE: 150) (*Figure 5.27*). Although the group who did not see cost as a barrier had a higher score, the difference between the groups was not significant (p = 0.2).

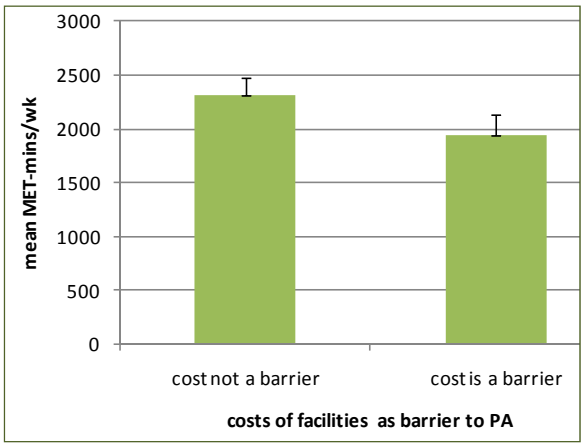

Figure 5.30 Mean MET-mins/wk in two groups, one of which reported 'cost of facilities' as a perceived barrier to PA, and one which did not.

'No-one to do it with' as a perceived barrier to PA

The group indicating that 'no-one to do it with' was a perceived barrier to PA (n = 14) had a mean MET-mins/wk score of 2016 (SE: 467) while the other group (n = 160) had a higher mean MET-mins/wk score of 2251 (SE: 129) (*Figure 5.28*). The difference between the groups was not significant (p= 0.61).

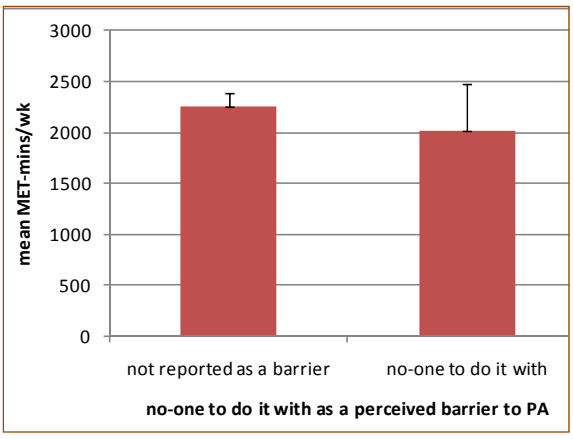

Figure 5.31 Mean MET-mins/wk in two groups, one of which reported 'no-one to do it with' as a perceived barrier to PA, and one which did not

'Not aware of facilities' as a perceived barrier to PA

One of the options available in the question on 'what prevents you from being more active' was 'not aware of what facilities or classes are available.' The group indicating that this was a perceived barrier was very small (n = 6) and had a mean MET-mins/wk score of 2915 (SE: 904) while the other group (n = 168) had a mean MET-mins/wk score of 2208 (SE: 129) (*Figure 5.32*).

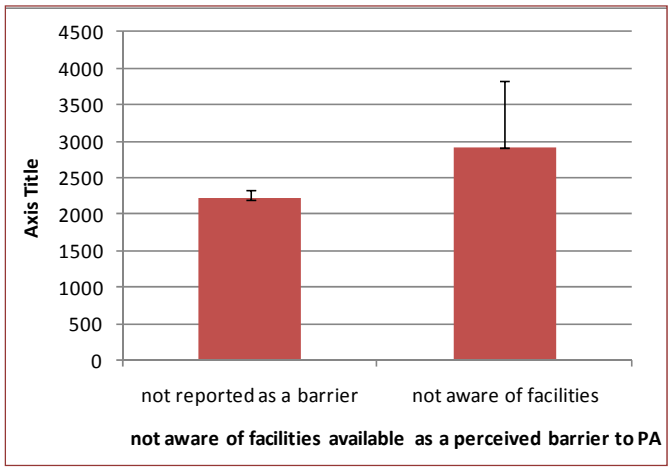

Figure 5.29 Mean MET-mins/wk in two groups, one of which reported 'not aware of availability of facilities' as a perceived barrier to PA, and one which did not.

An expected result was that there would be a higher level of PA in the group who did not report lack of knowledge of classes and facilities as a barrier but in fact this group had a lower mean MET-mins/wk score. However, there was no significant difference between the groups (p = 0.3)

'Facilities not available when I can attend' as a perceived barrier to PA

The group (n = 12) indicating that facilities were not available 'when I can attend' was a perceived barrier had a mean MET-mins/wk score of 2357 (SE: 509) while the other group (n = 168) had a mean MET-mins/wk score of 2223 (SE: 129). Mean scores are displayed as a bar chart in *Figure 5.30*. An expected result was that the group who did not report non-

availability of facilities when they could attend as a barrier would have a higher level of PA, but in fact had a lower score. However, there was no significant difference between the groups (p = 0.7).

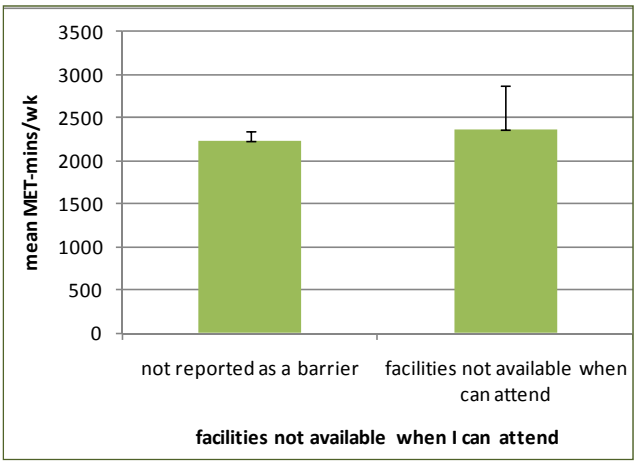

Figure 5.33 Mean MET-mins/wk in two groups, one of which reported 'facilities not available when I can attend' as a perceived barrier to PA, and one which did not.

Results of qualitative analysis

What prevents you from becoming more active?

An option in the 'barriers to PA' question allowed for free text responses. Twenty seven respondents (15.5%) provided a range of answers, from poor health or recovering from surgery, to lack of free time and other commitments including workload.

Two respondents stated that they tended to be physically active in cycles and sometimes they lost 'momentum' or had strayed out of the habit of being regularly active. Only one person cited stress as a barrier indicating that they had recently experienced a busy and stressful time which implied that this might not be a permanent issue.

Another respondent noted that they paid gym fees thinking this would provide an incentive, but even this wasn't enough. Two people cited pregnancy as a reason for not being more

physically active and two others said that the amount of commuting they did left little time and energy for PA.

Finally, other individuals said that poor weather, being overweight or being lazy prevented them from being more active.

Chapter 6: Discussion and conclusions

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This observational study examined associations between different levels of physical activity (PA) and stress in a specific population of 174 NHS employees (managerial, administrative and clerical staff, but not clinical staff). Overall, there was a consistent negative correlation between self-reported levels of stress and the amount of self-reported PA undertaken. As levels of PA increased, levels of stress tended to decrease. It can therefore be confirmed that people who are physically active report less stress than people who are more inactive. Those who are the most active had the lowest level of stress and the largest advantage was seen between the low and moderate activity groups.

When results were separated for age groups, health status and income levels, some of these effects, especially for job bands (as a proxy for income levels) and health, could be confirmed. Therefore the hypothesis that there is a significant relationship between stress and levels of PA can be accepted, but the direction of the relationship cannot be confirmed.

Overall the subgroup analyses showed that there were no significant differences in levels of PA by gender, carer status, commuting distance of transport methods. Perceived barriers to PA produced mixed results, since some of the subgroups were very small, resulting in very skewed data. Some expected results were not confirmed, for example, injury, work commitments, low levels of energy and lack of awareness of available facilities did not present significant barriers to PA.

All subgroups reporting these as perceived barriers nevertheless achieved moderate levels of PA (at least 600 MET-mins/wk), suggesting that the subjects reporting these barriers are

already active and would like to be even more active. For example, where injury is concerned, the higher levels of PA found amongst this group suggests that the injuries may be sports-related, as suggested by previous studies: 'Sport participants had the highest proportion of all-cause and activity-related musculoskeletal injuries among both men and women.' (Department of Health, 2004).

Stress and PA

A specific subgroup analysis with direct relevance to the main hypothesis investigated whether work-related or personal stress was perceived as a barrier to PA. In the group which reported work-related stress as a barrier, activity levels were lower but there was no significant difference between the two groups. In the personal-stress group, however, the mean MET-mins/wk score was higher than for the group not reporting this as a barrier, although there was no significant difference between the groups. However, the numbers in both these groups are very small (n = 14) with wide error margins and because the data is likely to be very skewed, no firm conclusions can be drawn from these results.

Age groups

When the sample was stratified into age bands, the secondary hypothesis - that PA levels would differ amongst age groups - was confirmed as there was a significant difference ($P = 0.02$) between 51-60 year olds and the two youngest age groups, 21-30 and 31-40. This difference could be explained by several possible socio-demographic factors: that the older age group no longer have childcare responsibilities and have more leisure time to devote to active pursuits; that they are more likely to be in higher-paid jobs as they are progressing through a career path and therefore have more disposable income for expenditure on leisure activities and gym membership fees; and finally, that with increasing age they are becoming more health-conscious and aware of the importance of PA for reducing a wide

range of health risks associated with age, from cardio-vascular disease to osteoporosis. In addition, given the female-dominated workforce (65% in the wider SHA staff group and 77% in this study sample), health awareness is likely to be higher because women are traditionally the 'gatekeepers' of the family's health and tend to be more health aware than men (Men's Health Forum, 2010).

The oldest age group (60-plus), however, demonstrated the lowest levels of PA and also the lowest levels of stress but since this 60-plus group was a very small sample (n = 5), the number may be too small to provide firm conclusions. Some specific confounders to be taken into consideration include that this age group is more likely to be working part-time which might reduce work-related stress.

However, a limitation of the survey was that respondents were not asked whether they were full- or part-time employees so there is no firm data on this issue. Other factors include that this older age group may have other external factors which could reduce stress levels – for example, they are unlikely to still have dependent children, and may be in higher status and higher-paid jobs, and thus in more financially and socially secure positions than younger colleagues. Alternatively, they may have formally retired but returned to part-time work in less demanding roles, which would also be a factor in stress levels.

Gender

A secondary hypothesis was that there would be a significant difference in the amount of PA undertaken by men and women. Despite being more health aware, in general women display lower levels of physical activity and may experience more barriers to exercise than men (Anderson, 2003, Azevedo et al., 2007). In this sample, mean scores for men in MET-mins/wk are very slightly higher (1 MET-min /wk) than for women; but it is worth noting

that the error margin for the men's scores is much wider because of the small sample size [n = 35]). However, there was no significant difference between the groups and therefore the hypothesis was rejected. It is also worth noting that men report slightly higher stress levels than women, but since there is virtually no difference in reported PA between men and women in this sample, it is not possible to say whether this supports the main hypothesis of a correlation between PA and stress levels.

Job/income bands

The secondary hypothesis was that there will be a significant difference in the amount of PA undertaken by staff in different income bandings with a trend showing that as income increases, levels of PA increase; this was predicted on the basis that people in higher job bandings tend to be older and therefore some of the same sociodemographic factors found in older age groups, such as more leisure time and higher disposable income (which remove some barriers to PA) would come into play.

There was a significant difference in levels of PA between groups ($p = 0.03$) and there was a strong association between levels of stress and levels of PA in some groups, notably the very senior manager (VSM) group. However, while the two highest mean scores for PA were found in the two highest job bandings (9 and VSM), there was no consistent trend for PA to increase with higher job bands: the next two most senior job bands (8c and 8d) show lower scores than jobs at all the more junior grades, except for bands 6 and 8a. Bands 8c and Band 8d, which showed the lowest mean PA scores in the more senior bands (8, 9, VSM) did however show some of the highest stress scores.

Although the secondary hypothesis can be accepted to some extent, the stratification by job banding provides a mixed picture. Partial explanations for this may be that middle managers

experience higher levels of stress than colleagues in lower or higher grades (Peter & Siegrist, 1997), while other research has shown that levels of stress, anxiety, and depression in managers in the NHS 'seem to be high and perhaps higher than expected.' (Caplan, 1994) which may confound results on correlations between PA/stress and PA/job bandings.

Secondary hypothesis: Carer/family commitments

There was a fairly substantial group of carers within the study sample (30.4%, n = 53) and the mean score for MET-mins/wk was slightly lower in this group than for the non-carer group. Since the analysis shows that there was no significant difference between the groups, the secondary hypothesis can be rejected.

However, a limitation of the questionnaire was that it did not ask respondents to specify whether they had caring responsibilities for children or for adults (e.g. a disabled or older family member), or both. Parents with dependent children, for example, might be expected to achieve more PA a week through lifestyle-embedded activity (such as walking to school) or take part in more leisure time games and sport as a family activity; whereas those who have caring responsibilities for disabled or older adults are likely to have less leisure time for their own activities.

There was no significant difference in stress levels between the two groups, either, although having caring responsibilities increases the risk of stress (Carers UK, 2009). Since the means for both groups were well above the cut point for 'moderate' levels of activity (600 MET-mins/wk), this suggests that if people with caring responsibilities manage to maintain PA at a level which confers health benefits, then this may also moderate stress they might be expected to experience in their caring role.

Secondary hypothesis: Commuting distance

It was expected that people who had the furthest to travel might use a car, which would cut down opportunities for walking (for example, to and from bus stops); alternatively, if people were commuting long-distance by public transport, this might impact on their opportunities for leisure-time PA.

However, there was no clear association between levels of PA and distance of commuting. The highest levels of PA were found in the groups which commuted 6-10 miles and 11-19 miles, but all groups achieved moderate (at least 600 MET-mins/wk) levels of activity. There was no significant difference between the levels of PA in the groups and therefore the hypothesis was rejected. The covariate which is most likely to have a confounding effect on the relationship between commuting distance and PA is job banding, with staff on higher level bandings commuting the longest distances. Of the 41 staff who commuted over 20 miles, 61 % (n = 25) were in the highest bands (8a and above). Staff on the highest bandings (VSM) achieved the highest levels of PA. Previous research indicates that individuals in lower socio-economic positions (SEP) are more likely to report engaging in job-related PA. Higher SEP individuals are more likely to report leisure time PA and sports activity (Ford et al. (1991), cited in McNeill et al., 2006).

Analysis of *methods* of commuting showed that slightly over half the group (n = 95) used public transport, including walking, or cycling as transportation method and since this group is dispersed through the 'commuting distance' group, this may have affected overall reported levels of PA. Mean MET/mins/wk for the group who mainly work from home was slightly lower than for the group who worked from office bases, but there was no significant difference. It is possible that those who work from home have more time available during the day to undertake structured exercise which would otherwise be spent on commuting.

It was expected that working from home might be less stressful, but while the mean of stress levels for home-based staff was slightly lower than for the other group, the difference did not reach significance. One explanation could be that lack of work-related social interaction for people working at home could increase stress levels, or that it is harder to set boundaries between home and work life and 'switch off' outside working hours. However, it must be noted that the numbers of people working at home is small (n = 8) and so the data could be skewed.

Secondary hypothesis: Commuting methods

Although the group who commute by public transport generally showed higher levels of PA than those who commute by car, there was no significant difference in the means for both groups, with activity levels falling into the 'moderate' category (at least 600 MET-mins/wk) for both; therefore the hypothesis that people using public transport will achieve higher levels of PA can be rejected. Both groups were sizeable, and therefore it is unlikely the data is skewed.

Health status

There was a significant association between self-reported health status and mean-MET mins/wk, with the highest levels of PA reported amongst the groups with good or very good health and a clear trend showing an increase in activity levels is associated with good health. However, this type of study is not able to determine the direction of the effect: that is, whether in this cohort health is improved or maintained by PA or whether people in good health are more likely to achieve higher levels of PA than those in poorer health. There is a also the possibility of a 'virtuous circle' effect, in that achieving better health through

increasing PA may encourage people to maintain or increase their exercise and fitness levels.

There is, however, a substantial body of evidence from previous research, including prospective studies, indicating that maintaining or increasing levels of PA improves health (WHO, 2010) and reduces risk of major non-communicable diseases such as heart disease and cancer.

Results of the analysis on health status complemented the analysis of the survey question on perceived barriers to PA which included the option of 'poor health'. Only a small number (n = 5) reported this as a barrier, and while the difference between mean MET-mins/wk for this group and the other group did not reach significance, the 'poor health' group activity was notably less, though with a wide margin of error (687); the small number in this group makes it likely the data is skewed.

Barriers to PA

Of the 14 different interactions tested for as perceived barriers, none reached statistical significance, except for health status, as discussed above.

It is worth noting, however, that the result of the work commitments subgroup analysis was tending towards statistical significance ($p = 0.06$). This group was one of the largest subgroups (n = 62) with small error margins, but contrary to expectations, had a higher mean of MET-mins/wk. One possible explanation is that the subjects who achieve higher levels of PA while still perceiving work commitments as a barrier to doing more PA may well be Type A people, who assess their situations as more challenging than they really are (Friedman & Rosenman, 1974).

Overall, the findings that the groups reporting perceived barriers to PA do not have statistically significantly lower means than the other groups suggest that the barriers are more apparent than real, since in each analysis, the means are within the 'moderate' range of activity. Alternatively, it suggests that those reporting barriers might wish to achieve higher (possibly 'vigorous' or at least 3,000 MET-mins/wk) levels of activity if the barriers were overcome.

Limitations of the study

Although one strength of the design was that the term 'work-related stress' was clearly defined within the questionnaire, the study is based on self-reported data, which limits reliability and validity of the results. In addition, since it is a cross-sectional design, no causal interpretation of the results is possible.

Another limitation was that the questionnaire did not allow accurate assessment of intensity the activities reported. For example, respondents were asked to report on how many bouts 'purposeful' walking – lasting at least 10 minutes – they undertake each day. However, this does not indicate whether the purposeful walking resulted in raised heart rate, or becoming slightly breathless, indicating the intensity of the exercise. In addition, there was no data on the time of day when the exercise was undertaken (for example, a lunchtime walk, which might affect perceived stress levels at work). Some experimental trials have shown that the intensity of exercise is a factor in determining the effects of exercise on mood (Biddle, 2000).

The IPAQ-based design of the questionnaire does not allow for separation of activity in work and in leisure time, which is another limitation since previous studies (for example,

Aszatalos et al., 2009) indicated that work-related PA in relation to job status (blue collar/white collar) can affect stress levels differently.

Another issue which needs to be considered is the timing of the survey within a wider political context. When the survey was circulated (in mid-June 2010), a new government had recently been elected and announced major organisational changes to the NHS including abolition of strategic health authorities. The uncertainty and anxiety this may have caused staff may also have affected people's perceptions of work-related stress at the time they were responding to the survey.

An improved design for future similar studies could include ways of more accurately measuring intensity and duration of bouts of PA, as well as including other more objective data (for example, sickness absence records) as well as self-perceived health status.

However, the findings from this study show that overall a change from low activity to moderate or high activity has a significant association with lower stress levels which strengthens the hypothesis that the two are causally related. Alongside this, there is a clear association between PA and health status, with higher levels of PA being associated with good health; and a strong association between levels of income, health and PA, which confirms long-standing associations found in previous studies.

While controlled trials or longitudinal studies may provide evidence for the direction of the effect for stress and PA, this study suggests that encouraging more physical activity as part of a healthier workplace, including redesigning jobs to be less sedentary, makes economic sense for individual organisations, the NHS and the wider economy.

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Appendix : Letter of ethical approval

North West 12 Research Ethics Committee - Lancaster
Barlow House
3rd Floor
4 Minshull Street
Manchester
M1 3DZ

Telephone: 0161 625 7818
Facsimile: 0161 237 9427

20 May 2010

Ms Loren C Grant

Dear Ms Grant

Study Title:	**The relationship between stress experienced in the workplace and motivation to be physically active both within and outside working hours.**
REC reference number:	**10/H1015/40**
Protocol number:	**1**

The Research Ethics Committee reviewed the above application at the meeting held on 13 May 2010.

Ethical opinion

The members of the Committee present gave a favourable ethical opinion of the above research on the basis described in the application form, protocol and supporting documentation, **subject to the conditions specified below.**

Ethical review of research sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

For NHS research sites only, management permission for research ("R&D approval") should be obtained from the relevant care organisation(s) in accordance with NHS research governance

arrangements. Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at http://www.rdforum.nhs.uk. Where the only involvement of the NHS organisation is as a Participant Identification Centre, management permission for research is not required but the R&D office should be notified of the study. Guidance should be sought from the R&D office where necessary.

Sponsors are not required to notify the Committee of approvals from host organisations.

a. the Committee would like to see the first e-mail revised to add a sentence after "complete" in the first paragraph "I may e mail you reminders about this survey to ensure I have included all potential participants

It is responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

Approved documents

The documents reviewed and approved at the meeting were:

Document	*Version*	*Date*	
Protocol	1	26 April 2010	
Investigator CV			
Evidence of insurance or indemnity		01 August 2009	
Letter from Sponsor		12 April 2010	
Letter from Statistician		16 April 2010	
Questionnaire: Validated		26 April 2010	
Student CV			
Letter from SHA		28 September 2009	
Screen shot of online survey			
First email invite	1	26 April 2010	
Follow up email invite (2 weeks)	1	26 April 2010	
Folllow up email (4 weeks)	1	26 April 2010	
REC application	2.5 corrected	27 April 2010	

Membership of the Committee

The members of the Ethics Committee who were present at the meeting are listed on the attached sheet.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Now that you have completed the application process please visit the National Research Ethics Service website > After Review

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the website.

The attached document "After ethical review – guidance for researchers" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Progress and safety reports
- Notifying the end of the study

The NRES website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

We would also like to inform you that we consult regularly with stakeholders to improve our service. If you would like to join our Reference Group please email referencegroup@nres.npsa.nhs.uk.

10/H1015/40	**Please quote this number on all correspondence**

With the Committee's best wishes for the success of this project

Yours sincerely

Dr Lisa Booth
Chair

Email: @northwest.nhs.uk

Enclosures: *List of names and professions of members who were present at the meeting and those who submitted written comments*
"After ethical review – guidance for researchers"

Copy to: *Professor Sarah Andrew*
Dr Stephen Fallows

Appendix : Invitation to take part in survey

****

1. First email invitation

Dear colleague

I would be most grateful if you would take a few minutes to complete a survey on your levels of physical activity and any work-related stress you might experience. The questionnaire should take no longer than 10 minutes to complete. I may email you reminders about this survey to ensure I have included all potential participants

I am interested in finding out about how physically active you are in your everyday life, at work, at home and in leisure time, and if this might be affected by levels of stress you experience at work.

This survey forms part of an MSc dissertation but the information gathered from this survey will also help NHS North West understand how it might be able to support staff to be more physically active, as part of the organisation's healthy workplace programme.

You will not be asked for any personally identifiable information or which directorate you work in. The questions will ask you about your physical activities in the last 7 days.

There are also questions about your age and gender, family or caring responsibilities, general state of health, levels of stress, your job banding and your office base. These have been included because they could all have an effect on levels of physical activity. Please answer each question even if you do not consider yourself to be an active person.

If the questionnaire raises any concerns for you relating to your well-being at work, you may wish to consider contacting the Occupational Health Service (contact details here) for advice.

Please click on this link which will take you straight to the survey page.

The findings will be shared with NHS North West once the MSc dissertation has been accepted.In the meantime, if you have any questions or would like more information about this project, please do get in touch (contact details below).

If you wish to raise any concerns or complaints about the research itself, please contact:

Professor Sarah Andrew
Dean, Faculty of Applied and Health Sciences
Chester University
Parkgate Road
Chester CH1 4BJ s.andrew@chester.ac.uk

2. Follow-up email invitation (two weeks after initial invitation) – first reminder

Dear colleague

I recently emailed you to invite you to take a few minutes to complete a survey on your levels of physical activity and any work-related stress you might experience.

Please accept my apologies if you have already responded to this questionnaire.

If for some reason you did not receive the previous email or have not yet had a chance to respond, the information below sets out the background to this project.

The survey should take no longer than 10 minutes to complete (link to survey).

Background to survey

I am interested in finding out about how physically active you are in your everyday life, at work, at home and in leisure time, and if this might be affected by levels of stress you experience at work.

This survey forms part of an MSc dissertation but the information gathered from this survey will also help NHS North West understand how it might be able to support staff to be more physically active, as part of the organisation's healthy workplace programme.

You will not be asked for any personally identifiable information or which directorate you work in. The questions will ask you about your physical activities in the last 7 days.

There are also questions about your age and gender, family or caring responsibilities, general state of health, levels of stress, your job banding and your office base.

These have been included because they could all have an effect on levels of physical activity. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, at home, in the garden, to get from place to place, and in your spare time for recreation, exercise or sport.

If the questionnaire raises any concerns for you relating to your well-being at work, you may wish to consider contacting the Occupational Health Service (contact details here) for advice.

The findings will be shared with NHS North West once the MSc dissertation has been accepted.In the meantime, if you have any questions or would like more information about this project, please do get in touch.

If you wish to raise any concerns or complaints about the research itself, please contact:

Professor Sarah Andrew
Dean, Faculty of Applied and Health Sciences

Chester University
Parkgate Road
Chester CH1 4BJ
s.andrew@chester.ac.uk

3. Follow-up email invitation (four weeks after initial invitation) – second reminder

Dear colleague

I recently emailed you to invite you to take a few minutes to complete a survey on your levels of physical activity and any work-related stress you might experience. Please accept my apologies if you have already responded to this questionnaire.

If for some reason you did not receive the previous email or have not yet had a chance to respond, the information below sets out the background to this project.

The survey should take no longer than 10 minutes to complete (link to survey).

Background to survey

I am interested in finding out about how physically active you are in your everyday life, at work, at home and in leisure time, and if this might be affected by levels of stress you experience at work.

This survey forms part of an MSc dissertation but the information gathered from this survey will also help NHS North West understand how it might be able to support staff to be more physically active, as part of the organisation's healthy workplace programme.

You will not be asked for any personally identifiable information or which directorate you work in. The questions will ask you about your physical activities in the last 7 days. There are also questions about your age and gender, family or caring responsibilities, general state of health, levels of stress, your job banding and your office base. These have been included because they could all have an effect on levels of physical activity. Please answer each question even if you do not consider yourself to be an active person.

Please think about the activities you do at work, at home, in the garden, to get from place to place, and in your spare time for recreation, exercise or sport.

If the questionnaire raises any concerns for you relating to your well-being at work, you may wish to consider contacting the Occupational Health Service (contact details here) for advice.

Please click on this link which will take you straight to the survey page. (link to be included in email). The questionnaire should take no longer than 10 minutes to complete.

The findings will be shared with NHS North West once the MSc dissertation has been accepted.In the meantime, if you have any questions or would like more information about this project, please do get in touch.

If you wish to raise any concerns or complaints about the research itself, please contact:
Professor Sarah Andrew
Dean, Faculty of Applied and Health Sciences
Chester University
Parkgate Road
Chester CH1 4BJ
s.andrew@chester.ac.uk

1. Introduction

We are interested in finding out about how physically active staff are in their everyday life, at work, at home and in leisure time, and if this might be affected by levels of stress they experience.

The information gathered from this survey will help NHS North West understand how it might be able to support staff to be more physically active, as part of the organisation's healthy workplace programme.

You will not be asked for any personally identifiable information or which directorate you work in. The questions will ask you about your physical activities in the last 7 days. There are also questions about your age and gender, family or caring responsibilities, general state of health, levels of stress, your job banding and your office base. These have been included because they could all have an effect on levels of physical activity.

Please answer each question even if you do not consider yourself to be an active person.

Please think about the activities you do at work, at home, in the garden, to get from place to place, and in your spare time for recreation, exercise or sport.

The questionnaire should take no longer than 10 minutes to complete.

2. Current physical activity

First section questions

1. During the last week, on how many days did you walk continuously for at least 10 minutes at a time? (including any leisure walking, walking to and from home and any purposeful walking)?

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7

2. On each of those days, typically, how many episodes of at least 10 minutes were there?

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ more

3. On average how many minutes did each episode last?

4. During the last week, on how many days have you done any kind of housework, gardening, DIY or building work?

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7

5. On those days, on average, how many minutes did you spend doing these things on each day?

6. During the last week on how many days did you take part in any sport or activity? For example, swimming, cycling, aerobics, dance, yoga, sports, or working out at a gym?

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7

7. On those days, on average, how many minutes were you active for each day?

8. Which of the following best describes you? Please tick only ONE

0

- ◯ I am not interested in being more physically active
- ◯ I have recently been thinking about becoming regularly active
- ◯ I am intending to become regularly active within the next six months
- ◯ I have recently become active on a regular basis
- ◯ I have been regularly active for at least six months

9. If you would like to be more physically active, what prevents you from becoming more active? In the list below, please tick whichever ones apply to you.

- ☐ Injury
- ☐ Poor health
- ☐ Distance to facilities
- ☐ Dislike sport/exercise
- ☐ Family/carer commitments
- ☐ Work commitments
- ☐ Low level of energy
- ☐ High level of stress in my personal life
- ☐ High level of stress in my work life
- ☐ Lack of transport
- ☐ Cost of facilities
- ☐ No-one to do it with
- ☐ Not aware of facilities/classes available
- ☐ Facilities not available when I can attend

Other (please specify)

5

6

3. General health

General information about individual health and wellbeing

1. How would you describe your general health?

- ◯ Very good
- ◯ Good
- ◯ Fair
- ◯ Poor
- ◯ Very poor

2. Definition of stress

The Health & Safety Executive's formal definition of work-related stress is:
"The adverse reaction people have to excessive pressures or other types of demand placed on them at work."

Stress is not an illness – it is a state. However, if stress becomes too excessive and prolonged, mental and physical illness may develop.

There is a difference between pressure and stress. Pressure can be positive and a motivating factor, and is often essential in a job. It can help us achieve our goals and perform better. Stress occurs when this pressure becomes excessive. Stress is a natural reaction to too much pressure.

A person experiences stress when they perceive that the demands of their work are greater than their ability to cope. Coping means balancing the demands and pressures placed on you (i.e. the job requirements) with your skills and knowledge (i.e. your capabilities).

Stress can also result from having too few demands, as people will become bored, feel undervalued and lack recognition. If they feel they have little or no say over the work they do or how they do it, this may cause them stress.

How would you describe your stress levels when you are at work?

- ◯ I feel stressed almost all the time
- ◯ I feel stressed some days each week
- ◯ I feel stressed once or twice a week
- ◯ I feel stressed about once a fortnight
- ◯ I feel stressed about once a month
- ◯ I hardly ever feel stressed

4. Physical effort related to work

General information about physical effort required at work

1. In terms of physical effort, how would you describe your work?

- ◯ Very demanding
- ◯ Fairly demanding
- ◯ Not very demanding

2. When you are at work, are you mainly…

- ◯ Standing up
- ◯ Sitting down
- ◯ Walking about

3. How do you normally travel to and from work? Please tick all that apply

- ☐ Public transport
- ☐ Walk
- ☐ Car
- ☐ Work at home
- ☐ Cycle

4. How far do you travel to work?

- ◯ Under 1 mile
- ◯ 1-5 miles
- ◯ 6-10 miles
- ◯ 11-19 miles
- ◯ 20 miles or more

5. About you

General background information (not personally identifiable)

1. Are you...?

- ◯ Male
- ◯ Female

2. Age group

- ◯ Under 21
- ◯ 21-30
- ◯ 31-40
- ◯ 41-50
- ◯ 51-59
- ◯ 60+

3. Please indicate on which AfC band your job role is currently set

- ◯ Band 1
- ◯ Band 2
- ◯ Band 3
- ◯ Band 4
- ◯ Band 5
- ◯ Band 6
- ◯ Band 7
- ◯ Band 8a
- ◯ Band 8b
- ◯ Band 8c
- ◯ Band 8d
- ◯ Band 9
- ◯ Very Senior Management

4. Please indicate which building is your usual place of work

- ◯ Piccadilly Place
- ◯ Barlow House
- ◯ Regatta Place
- ◯ Quayside
- ◯ Usually work from home

6. Thank you

This is the end of the questionnaire

Thank you very much for taking the time to participate